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AN
ENQUIRY
 INTO THE
 NATURE and VIRTUES
 OF THE
 MEDICINAL WATERS
 OF
B R I S T O L,

And their Use in the CURE of
 CHRONICAL DISTEMPERS.

By P. KEIR, M. D.



L O N D O N:

Printed for R. WILLOCK, at Sir *Isaac Newton's*
 Head, in *Cornhill*, and sold by J. LEAKE at
Bath, and J. LEWIS at *Bristol*. 1739.



ANATOMY

INTO THE

NATURE AND

OF THE

MEDICINAL WATERS

OF

BATHS

AND THEIR USE IN THE TREATMENT

CHRONICAL DISEASES

BY R. K. M. D.



LONDON

Printed by J. W. Smith, at the Press of the
University of London, 1854

P R E F A C E.

F*EW mineral waters, in this kingdom, of any considerable efficacy, have been treated of to less advantage than those of Bristol, though perhaps there are none, from the analysis and discovery of whose compounding principles, practical conclusions may with greater certainty be deduced. As the following enquiry is the result of experience and observation, and contains nothing removed from common apprehension,*

hension, any person, who will take the trouble, may qualify himself to be a judge of it.

Other Physicians may have made the like, or more experiments upon the same subject, but as they have not thought proper to communicate their knowledge to the publick, this attempt to place so excellent a medicine in a clearer point of light, and to render its benefits more diffusive, will, I hope, be esteemed neither useless nor unnecessary.

Bristol, July 25.

1739.

A N



A N
ENQUIRY
INTO THE
NATURE and VIRTUES
OF
BRISTOL WATER.



C H A P. I.



IN the consideration of natural things, we can never hope to attain to an adequate knowledge. Our senses are too gross to dive into the constituent frame and inward texture of bodies; and our capacities

The NATURE and VIRTUES

ties too narrow to comprehend the great and intricate scheme of nature. We may, however, be permitted to reason upon all things, as long as we do not pretend to certainty, nor endeavour to pass our own opinions upon others for demonstration: for, as all we really know of this sort, is founded upon experiments, if we make a right use of these, by carefully collecting various observable properties of bodies, diligently comparing them one with another, and from thence drawing just and solid inferences, we can hardly fail making some advances towards the discovery of natural truths. This seems to be all we can reasonably expect in such researches; and as we are endowed with no speculative knowledge in these matters, we can never declare precisely how things are, but must be satisfied if we can conceive how things may be, provided our notion of them does not imply any contradiction.

IN this short account of Bristol Waters, I do not pretend to have exhausted the subject; a curious enquirer might, without doubt, have composed a much more accurate system both of their qualities
and

of BRISTOL WATER.

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and virtues. All I propose, is to set down such circumstances as appear to me to contribute chiefly to the producing some of those salutary effects, for which these waters are so universally recommended; leaving the causes less discernible, to the investigation of persons of superior abilities.

WHAT is premised concerning water in general, and the origin of mineral springs, will not, I hope, be deemed unnecessary, since it may be of service to illustrate some points in the subsequent discourse, which otherwise might appear obscure to such, whose studies do not naturally lead them into such pursuits.

S E C T. I.

Of WATER in general.

The uni-
versality
of water.

WATER is so universally diffused, and so remarkably dispersed every where, that some of the antient philosophers, and among the rest * Thales Milesius, one of the Grecian sages, imagined it to be the original principle of all things. They considered it as the sole nutriment by which all bodies were supported, into which they might ultimately be resolved; and that all their increase, as well as different qualities, were owing only to the apposition or modification of this mother of matter.

THIS, indeed, seems to be enlarging beyond the bounds of probability; nevertheless, when, upon examination, we find water to reside almost every where, and to enter the composition even of the driest and most solid bodies, from most of which some quantity may easily be extracted;

* Thales dixit aquam esse initium omnium rerum.
Cicero de natura deorum.

tracted ; and when we observe the remarkable changes such bodies undergo when the element is drawn off, we must acknowledge that water not only constitutes a considerable part of their real substance, but that it is to this they, in a great measure, owe their very form and appearance.

AND in respect of the human structure, if water is not elementarily nourishing, and convertible into its real substance, as some have maintained ; yet it is certainly the most universal vehicle, conveying into our bodies the nutritious particles, by which the constant and necessary expences of life are continually repaired ; so that neither life, nor health, could long subsist without the concurrence of this so necessary an ingredient.

ALTHOUGH water seems to be a necessary constituent part of all bodies, and to be plentifully diffused every where, yet it is very difficult, if not impossible, to obtain a pure simple elementary fluid, perfectly unmixed with any thing foreign, or heterogeneous. Nature has bestowed no such upon us, and no art has hitherto been able to procure it. Infinite numbers
of

Water never to be found absolutely pure.

of bodies may be so intimately dissolved in, and so thoroughly united with this element, as not to occasion the least sensible change in the appearance, or sometimes, by any known contrivance, be separated.

Rain-water.

Thus rain-water, justly accounted the purest of any, abounds with a great variety of corpuscles dispersed in the air, and mixed with the elements of water, as they ascend in vapours, are carried about in clouds, or descend into rain. In like man-

Fountain, river, and well-waters.

ner, fountain, river, and well-waters, the necessary consequences of vapours and rain, not only contain these now mentioned particles, but may likewise be impregnated by others, according to the different strata, or beds, over which they pass in their course through the earth, if, by chance, they meet with any thing capable of being dissolved by them.

The diversity of water.

So that water, by custom called so, is really a compound liquor, whose only diversity consists in the different quantity, and various properties of foreign particles, mixed with the element, and distributed through it. And whatever is said of the goodness or badness of waters, can be only under-

understood with regard to their particular contents.

WE need not therefore amuse ourselves here with an unnecessary disquisition about the nature and qualities of the simple element itself ; it suffices for our present purpose, to consider it as an uniform homogeneous fluid, capable of dissolving other bodies, keeping them suspended in its substance, and carrying them along with it under a liquid form.

SINCE then water is not to be found absolutely pure, and since this compound liquor is daily made use of for most of the purposes of life, and the defect thereof can by no other means possibly be supplied, it is surely of the greatest consequence to understand well the particular qualities of the waters of every place. It ought, one would think, to be one of the chiefest cares of every physician, wherever he takes up his residence, diligently to enquire into this article ; and I am persuaded, many * endemical distempers have

The necessity of examining the waters of every place.

* Aqua gravior convertit invisibilem perspirationem in ichorem ; qui retentus, & deinde non resolutus, magna ex parte in cachexiam facessere solet. Sanctorii Med. Statica, sect. ii. aph. 6.

have their origin from this cause ; which, if carefully attended to, might, without great difficulty, be amended. The antients laid great stress upon this head, and were very careful in laying down rules to direct us in the choice of water. Hippocrates * is every where full of it ; so is Pliny ; † and Herodotus, lib. iii. cap. 125. mentions a people in Æthiopia, called Macribioi, or the Long-livers, who usually lived to the age of 120, or upwards ; which he attributes chiefly to the purity of their waters.

The danger of bad waters.

I am surpris'd the mischiefs arising from indigestible and crude waters can pass unregarded : for how is it possible to avoid distempers, when hard unalterable particles are daily conveyed into our blood along with our liquid, as well as solid foods ? notwithstanding they may be small enough to pass through the lacteals with the chyle, and circulate for some time in the larger vessels, without any manifest detriment ; yet is there all the reason in the world to apprehend the greatest inconveniencies from them, when they arrive at
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* De aeribus aquis & locis.

† *Historia naturalis.*

of BRISTOL WATER.

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the extremities of the minutest capillaries. The element itself may possibly get through, but the heterogeneous unalterable particles, now destitute of their dissolving fluid, will, in all probability, prove too gross to follow; and not yielding in figure to the pressure, must necessarily, by the subsequent force of life, be impelled into these small vessels, as far as the power of the succeeding circulation can drive them. There they must stick, and create an almost irresoluble obstruction, there being very little hopes of restoring the lost circulation in a canal, whose diameter is, perhaps, no larger than a single particle of the obstructing matter may fill. Besides, many of such unconquerable and crude particles, separately taken into the body, when they come to be increased in number, and carried about with the blood, may occur in their course, by their own attractive force cohere together, or unite with some viscous humour; and thus, by degrees, create obstructions in the larger vessels, or form various concretions and petrefactions in different parts of the body. Surely if death, merely from old age, is

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Death
from old
age.

owing to the coalescence of the sides of the vessels, or the concretion of the vessels with their contents into impervious fibres, putting a stop to the necessary circulation of the vital stream, as is, I think, agreed on by physicians, as well as naturalists, hard and indigestible waters may justly be reckoned among its chief instruments. The use of these is alone sufficient to shorten the lives of all the sons of Adam ; and the curse pronounced against the ground, seems likewise to have extended to the waters.

BUT as it is not the present design, to treat methodically, and professedly, of the nature and uses of common water, I forbear enlarging further upon this head, and shall only remark, that in the choice of water for common use, that generally is to be preferred which is freest from foreign mixture, and is known by being the lightest, most inodorous, insipid, pellucid, and incorruptible.

IT must be observed however, that it does not from hence follow, that the lightest waters are always the purest, since there are many things capable of being
dissolved

dissolved in water, and suspended, that are specifically lighter than water itself; as is evident in rain water, wherein are contained infinite numbers of bodies, which were so light as to be suspended in the air, a much lighter fluid than water. But light waters are therefore wholsomer, and more eligible; because, the particles that are heavier than the elements of water, are, for the most part, of a hard, unalterable, petrefying quality, incapable of being attenuated and overcome by the force of the natural powers; and consequently, their use must be pernicious and destructive to health; whereas, the lighter spirituous particles are generally so subtile, as to pervade the minutest vessels, and find a way, through the straitest passages together with the watery element, and thus be eliminated by some of the common emunctories, without occasioning any considerable irregularity in the movements of the animal machine.

FOR this reason was rain-water, duly received, ever accounted the healthiest, the heterogeneity of its parts being chiefly owing to animal and vegetable exhalations,

and though apt to putrify in a short time, will recover its pristine purity as soon as the fermentation is over, and the foreign particles are evaporated, * or subside.

* *Aquarum nullâ arte confectarum, quæ quidem ab æthere, aut cum tonitru delabitur tempeſtiva, bona eſt, quæ vero procelloſa mala. Hipp. ſexto epidem, ſect. iv. art. 17.*

Pluvialem aquam, Hippocrates inquit, eſſe breviffimam, dulciſſimam, liquidiffimam, & tenuiſſimam, quoniam ſol leviſſimum tenuiſſimumque trahit; idque non ſolum ex aliis aquis, verum etiam ex mari & corporibus. Paul. *Æginet. de tuenda valetudine, lib. i. cap. 50.*

S E C T. II.

Of Medicinal Waters.

WHATEVER is dissolved in the watery element, and therewith taken into the human body, will, of necessity, occasion some alteration in the animal oeconomy.

IF this alteration happens to be such as Poisonous waters. tends to clog the springs of life, and disturb the order and regularity of the functions, waters thus impregnated are justly condemned as noxious and poisonous. But if it can be of service to correct or discharge what is degenerated or superfluous, Medicinal waters. and thereby procure or promote a more uniform motion in the Parts of the human machine; waters possessing such qualities in any eminent degree, do then acquire the title of medicinal, and under proper regulations, are, by daily experience, found to be the most sovereign and effectual remedy in the alleviation and cure of
obstinate

obstinate and inveterate chronical distempers.

FOR herein do the productions of nature infinitely excel all the preparations of art (especially in the cure of chronical diseases, whose seat lies generally in the smallest capillaries, and glandular system) that few of the most noted and approved medicines, can ever reach so far as to be able to remove the cause, and seldom carry their virtues beyond the second or third rate of vessels; yea, many of them, it is to be feared, act no further than the first passages; and thus the stomach often suffers, and is in vain overcharged with a load of medicines, while the part affected lies beyond the reach of such coarse fare. Quite otherwise in the productions of nature, the salutary particles are so exceedingly subtle, as to be able to penetrate to the innermost recesses of the human structure, there resolve every preternatural cohesion, and open a free passage for the interrupted circulation, that the proper secretions may again be duly and regularly performed; for in this does the preservation of health chiefly consist.

WATER,

WATER, we find, has a power of dissolving certain bodies, which it meets with in the bowels of the earth, in such a manner, that, together with them, it appears to be one homogeneous liquor. By this means it acquires different qualities, and becomes endued with the singular virtues peculiar to the nature of that matter, which lies in the channels through which the waters pass, whether it be metallic, sulphureous, terrestrial, or saline.

The dissolving quality of water.

HENCE the origin of medicinal springs, which are as various in their operation and effects, as are the contents dissolved in the element, or the different proportion and combination of such contents united together by the mediation of water. For there being few mineral springs, if any, wherein one particular sort of matter only is dissolved, their salutary effects do generally arise from the united action of the whole composition. There is indeed, for the most part, one particular ingredient which predominates, and from whence the whole oftentimes obtains its denomination. Thus, where the ferrugineous principle evidently prevails, the water is called

The origin of medicinal waters.

Their various denominations.

called chalybeat; where allum, vitriol, or sulphur abound, they are termed aluminous, vitriolick, or sulphureous. Sometimes medicinal waters receive their appellation from the changes and effects they produce in the human body, and are called alterative, or evacuant. Sometimes from the singular impressiion they make on our sense of feeling, when we distinguish them into thermales, hot; and acidulæ, cold.

Water
cannot
dissolve all
bodies.

BUT though, in the different classes of medicinal waters, we find a remarkable diversity of substances contained, as sundry sorts of salts, metals, earths, and sulphurs; yet must it not from thence be inferred, that water, of itself, is really capable of dissolving all such bodies. No one will venture to say, that the watery element alone can dissolve the least piece of iron, without the intervention of some other help. The particles of the heaviest metal may, indeed, be so far divided, and have their surfaces so far extended, as to swim, and be suspended in a fluid specifically lighter than themselves; but this is widely different from the same being inti-

intimately dissolved in, and incorporated with the elements of water, as when a piece of gold is dissolved in aqua regia, which is a water abounding with a volatile sea salt.

WATER then is not properly the solvent of these bodies we find dispersed through its substance; but these bodies are first acted upon, and dissolved by a menstruum, and both together are afterwards diluted in water.

FOR the better explaining of this position, let us examine first, what water of itself is capable of dissolving. And, secondly, what it will dissolve by the help of a medium.

PURE water dissolves all manner of salts of all denominations, both simple and compound; and these we find, by experience, to be the only substances naturally capable of uniting with water, and being added to it, without increasing its bulk; so that we may reasonably conclude, that the particles of salt have a figure adapted to insinuate themselves into the interstices of water. This appears plainer, in that water, after it is saturated with

Water dissolves salts.

one kind of salt, is still capable of dissolving a considerable quantity of another; and after that, of a third or fourth, without parting with any of the former; which seems to be owing to the different figures of salts; those of one not being able so to fill up the interstices, but there may be room left still for some of another figure to enter.

Thus water is the only proper solvent of salts. Other bodies it does not influence without the concurrence of some medium, their particles being no ways adapted to enter the vacuities formed between the watery globules, till they are first joined to the menstruum, which is indeed no other than salt itself.

Salt the
solvent of
other bo-
dies.

FOR as water is the proper solvent of salts, so is salt the proper solvent or menstruum of whatever else we find dissolved in water. Thus salt dissolves

1. Metals. A clean metal may lie for ages in pure water, without losing a grain of its substance, or undergoing the least change in appearance; but if a proper salt be applied to this metal, its parts will insensibly be worn off and corroded, the
saline

saline and metallic particles will then unite into vitriols or cryffals, which may intimately be diffolved in water. The particles of falt abrade thofe of the metal, carry them along into the interftices of the water, and keep them fufpended there, fo long as they themfelves remain diffolved.

HERE it is to be noted, that falts, before they can diffolve metals, muft themfelves firft be diffolved in water, that their particles may be the more divided, and more at liberty to aét upon the metal, and reduce it into vitriols, which are a combination of the corroded metalline fub-
 ftance, the folverit falt and diluting water, united in a certain proportion, and forming a transparent mafs, intirely diffoluble in water.

The nature of vitriol.

IF the metal is deprived of its folverit falt, it continues no longer fufpended in the element; as is evident in moft chalybeat waters, when the volatile diffolving falt is evaporated, the more fixed mineral contents fall to the bottom in form of an ochre.

IF the element is intirely drawn off a metallic vitriol, the metal and fixed falt

together remain a fine calx, without transparency.

THUS the void spaces, formed by the figure and contact of the elementary globules of water, are naturally fitted for the reception of the saline particles, and admit likewise the small particles of metals abraded by these salts, and annexed to them. By which means, metals are rendered potable, and, by experience, are found capable of producing very considerable medicinal effects; which is not to be wondered at, if we consider the composition of such a mixture, the metalline part communicating gravity and force, the salt adding a penetrative power, and the dissolving element serving as a vehicle to convey these active principles to the remotest extremities, all together concurring with a joint efficacy.

Gold, silver, mercury, lead, or tin, not be found in mineral waters.

BUT it is to be observed, that metals are not indiscriminately dissolved by every kind of salt. Gold, silver, and mercury, are never found naturally in a state of solution in the earth, they require a stronger menstruum than is to be met with there, to reduce them into crystal, viz. the

the acid of nitre, and spirit of sea salt. Lead and tin may indeed be easily dissolved; but the salt adheres so slightly to them, that there is hardly any fixing it, or keeping them united; so that in reality we find but two sorts of vitriol produced by nature, that of iron, of a green, and that of copper, of a blue colour. The bluish, the white, and the red, proceed from a proportioned mixture of both, or from the greater degree of heat in the production. Thus all native vitriols are owing to iron or copper; and it is in vain to expect any other metallic principle in mineral waters, since no metal can ever be rendered dissoluble, till reduced into vitriol by its proper solvent salt.

2. OILS, or sulphurs. Oily substances, we find, have a great resistance, or antipathy, if I may so call it, to unite with water; yet, by the addition of this medium, these two disagreeing antagonists may be reconciled into a perfect good understanding and union. Salt easily incorporates with oil, and therewith forms a saponaceous substance, capable of being dissolved

solved in water into one uniform homogeneous mixture.

The virtues of sulphureous waters.

WHEN these two substances of salt and sulphur are found united together, and thus dissolved in water, especially if they happen to be of a volatile nature, and properly tempered, such a composition must be endowed with wonderful virtues; and such waters cannot fail of being salutary in the highest degree, having a power of dissolving and attenuating the most obstinate cohesions and viscidities, resolving the most hardened obstructions, and opening a passage for the regular and uniform circulation of the vital juices; and thus, in a manner, renewing the current of life, when almost at a stand. Water of itself, though it has many singular virtues, yet would be insufficient to produce these salutary effects; but water, as the proper vehicle, conveys this resolving soap to the part affected, joins its own diluting quality, and afterwards serves to carry off the resolved matter which formed the obstruction.

The virtues of saponaceous medicines in fevers.

IT has been often observed in acute distempers, where the blood, by the violence

lence of the fever and heat, becomes exsiccated and adust, that no relief could be obtained from the plentiful use of simple water, notwithstanding its softening diluting qualities ; the water circulated in the vessels, unmixed with the glewy humours, till arriving at the renal glands, it was there separated, quite unaltered, without the least change in colour, taste, or smell. But if honey, according to the practice of Hippocrates, is added to the water, or saponaceous plants according to the modern improvement, are decocted in it, then does it easily mix with the viscid humours, divide their cohesions, and restore the regularity of the blood's motion. Almost every one knows the viscous fattiness which naturally adheres to silk and wool, can never be scoured off, or cleansed away by water, without the addition of some saponaceous matter ; as common or venice soap, urine, bile or gall, and the like substances, which are compounded of salt and oil.

3. SALT dissolves earth, and earthy substances ; as stone, chalk, lime, &c. and renders them capable of being diluted in water.

WATER

WATER alone may so far mix with many sorts of earths, as to separate their parts, and make them crumble. It may even keep some of the lightest particles suspended, and thereby become troubled and muddy; but it can never dissolve earth, so as at the same time to retain its transparency, and be incorporated with it, without the concurrence of a proper solvent salt, which corrodes the earthy particles in the same manner we have already described of metals; by which means, they may be so intirely dissolved in the liquid, that nothing of earth shall appear to our senses, though, by art, it may be easily extracted thence. Thus stones, shells, chalk, pearls, horns, bones, and all calculous concretions, are rendered soluble in water, as every one may easily experience. It is not, however, every kind of salt will corrode, or dissolve earth. If you take a piece of chalk, and boil it in the strongest lixivium of salt of tartar, it will still continue chalk; but put it into an acid liquor, as cold vinegar, it quickly disappears. In like manner, pearls, crabs eyes, claws, &c. may easily be dissolved in the juice of lemons.

S E C T. III.

Of the impregnation of mineral waters.

THUS we see that metals, sulphurs, and earths, remain indissoluble in water, without the addition of a solvent salt, which is absolutely necessary to render the others potable. And therefore we may venture to affirm, that wherever we meet with a water impregnated with these ingredients, there is likewise contained in it some kind of salt, fixed, or volatile; which is further confirmed à posteriori, every such water yielding always some salt or other in a sensible proportion, sometimes more, sometimes less.

WHAT the particular nature of these salts may be, is, perhaps, not so easy to determine; and though it may be sufficient, for our present purpose, to have evinced, that these salts, of whatever nature they are, are necessary to render o-

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ther

Salt necessary to render other bodies potable.

ther bodies diffoluble in water, yet fhall I take the liberty to offer my opinion ; which, whether well or ill grounded, I leave others to judge.

The vari-
ous na-
tures of
falts.

A great deal has been faid, and many learned arguments brought, to range them under the heads of acids, alcalies, and neutrals. Others have taken great pains to difcover the various figures and fhapes of different falts, and found them to differ, as they were aluminous, nitrous, or marine. But our fenfes, I fear, are too grofs to dive into the elemental ftructure and formation of bodies ; fo that for ought we know, or dare venture to affert, there may be as many elemental differences as there are fpecies of falts ; or perhaps all falts may, in their ultimate elements, be the fame, and all their differences may confift in the difference of more or fewer elemental parts, or the various combinations of faline particles with other bodies, whereby they put on different appearances, and produce different effects. So far is certain, that no two falts of the fame denomination, will, upon tri-
al,

al, answer in every respect the same proofs.

BUT as all our physical knowledge is experimental, and arises from what our senses discover in natural bodies, all their distinctions must be taken by sensible signs; and therefore, such distinctions are not without their proper uses, as they are expressive of some particular phenomena or appearances. If, for instance, to any liquor abounding with an acid, I add an alkali, instantly an effervescence will arise, and a conflict between two such opposite natures. We must not, however, go beyond experience, and infer from thence, that whenever two bodies meet together with an effervescence, the one is acid, the other alkaline, since some acids will raise a like effervescence with sea salt well purified, which yet is no alkali, but may be brought to yield a very acid spirit in aqua regia.

AGAIN, what will turn tincture of roses, violets, turnsole, and some other vegetables, red, we conclude an acid salt; what will turn violets green, we call an alkali. Acids in general, are found to dis-

E 2 solve

solve metals; all vitriols yield an acid, yet acids themselves differ almost as much from one another, as they do from alkalies: for it is not every acid that will dissolve every metal, some require their particular solvent; as we see in aqua regia, and aqua fortis, both strong acids, the one dissolving gold, but not silver; the other silver, but not gold.

WHILE we confine ourselves to experiment, there is no great danger of being deceived, provided the experiments are made justly; but when we come to assign speculative reasons for natural effects, we transgress our limits, and pass the bounds prescribed to the narrow comprehensions of men; so that we can never pretend absolutely to determine after what particular manner mineral waters are compounded, and the exact proportion of their impregnation, since so many, and so different substances may concur towards their production. All we can do, is to argue from experimental data, and to propose the motives that induce us to be of such an opinion, without exacting from others an implicate

plicite faith in what we ourselves can never be fully assured of.

THE antient writers on mineral waters, have mostly been of opinion, that their impregnating salt was originally an acid. This notion has been strenuously opposed by some authors (the first of whom, if I mistake not, was Hoffinan) who assert, on the contrary, that it partakes always of an alkaline quality ; because, say they, these waters, at the spring, never give the least indication of an acid by any experiment, and the salt extracted from them, approaches, in every character, nearer to an alkali.

The impregnating salt of mineral waters, by the antients generally accounted acid. By the moderns alkaline.

BUT notwithstanding so great authority, I can scarce think these objections of sufficient weight to invalidate the first opinion :

FOR, in the first place, let it be considered, that acids are frequently generated of non-acids. Sea salt discovers no sign of an acid, yet distilled with bole, or brickdust, yields a very volatile, strong, acid liquor. The same is true of nitre. In corn, or meal, there is not the least indication of an acid ; yet, by the action of

Acids may be generated

fermen-

and lost.

fermentation alone, both afford a remarkable acidity. If therefore acids may be generated, why may they not perish, and be lost? Actual acids are daily taken into the human body, and, by the power of life, are changed, and rendered alcalescent; for who ever yet obtained an acid from any part of an animal? Native tartar, which is acid, and causes an effervescence with alcalies, by the action of a moderate fire, may be converted almost intirely into an alkaline disposition.

So that it would seem, that acids, while they act as menstruums, lose their own nature, become concreted with the solvend bodies, changed into new ones, and perhaps rendered alkaline. Boerhaave, in his treatise of menstruums, tells us, that the sharpest acids, while they corrode their objects, are themselves changed by them, and put off all disposition to acidity. If crabs eyes be dissolved in spirit of nitre, and the solution be carried accurately to the point of saturation, you will have a limpid, and almost insipid liquor. Vinegar in saccharum saturni, or dissolved lead, does not continue vinegar there, but acquires

quires a great degree of sweetness, so as with propriety to deserve the name of sugar of lead.

IN the second place, I very much question, whether the salt extracted from mineral waters, will, upon due examination, be found to be in the least alkaline. I never could perceive any tendency that way in all the experiments I have had occasion to make; which leaves some room to suspect, that the authors of this opinion had probably made their experiments upon the whole sediment remaining after evaporation, without separating the salts from the other ingredients, sulphurs, metals, or alkaline earths. But I will not set my own opinion against the assertions of others.

The salt in mineral waters rarely alkaline.

WHEN we reflect that acids, both mineral and vegetable, are procured by the attenuation of bodies, and by the reduction of them nearer to their elemental parts, by fermentation, distillation, and fire. When we see that most plants yield a subacid liquor in distillation, and that most mineral salts are convertible into an acid spirit; but especially, when

The only simple, native, original salt is acid.

we

we find that this subtile, acid spirit, will with an alcali be regenerated, and therewith compose the same individual mother salt, from which the acid was extracted. And further, when we consider the near resemblance acids bear to one another when thoroughly depurated; the acids obtained from sulphur, allum, green, and blue vitriols, being the very same, and scarcely to be distinguished from each other, when rectified according to art.

AND lastly, that no native salts, with all the proper marks of an alcali, was ever yet discovered, all the fixed alkaline salts of vegetables being absolutely the creatures of the fire, uniting different parts; which, by a proper analysis, may be disengaged, and almost resolved into their constituent principles. When, I say, all these things are duly considered, shall we not have some reason to believe, that the only original, universal, natural salt, is a pure acid, by whose different union with, and impregnation of other bodies, is produced the great variety of salts of different denominations, exhibiting different phenomena, and endowed with different powers
of

of acting, according to the specifick nature, and various combination of their compounding principles.

So that supposing an alkaline salt might sometimes have been extracted from mineral waters, it cannot from thence be inferred, that the solvent salt was originally so; it is more likely, that in dissolving the impregnating mineral bodies, it had changed its nature, and uniting with them, of a simple become a compound, of an acid, been converted into an alkaline salt.

S E C T. IV.

The composition of mineral waters.

The composition of mineral waters threefold.

THE composition of mineral waters may, I think, be resolved into three parts ; the volatile spirit, the fixed contents, and the element itself, which serves as a vehicle and diluent to both.

Their mineral spirit.

THAT there is really, in most mineral waters, such a volatile spirit, no one can doubt, who considers the remarkable alterations they undergo, both as to colour, taste, and smell, after standing some time exposed to the air, or in a very gentle heat ; nay, it is sometimes of that wonderful tenuity, as not to be confined by any art or contrivance ; it escapes through the closest stopp, and even hermetically sealed glasses, and leaves the water, in a great measure, destitute of all medical virtue. Instances of this are common, and we meet with waters which will not be keeping

keeping a few hours, nor carriage a few miles.

THE chalybeat waters of Spaw and Pyrmont, continue good while this volatile spirit adheres to the metalline part, and keeps it dissolved in the element; but no sooner is that evaporated and fled, than the water becomes turbid, deposites an ochre, and grows immediately flat, and good for nothing. Whenever, therefore, we perceive a sediment in mineral waters, which were drawn clear from the spring, we may conclude for certain, their valuable part is lost.

THE specifick nature of this spirit some have thought impossible to determine, as it can by no means be fixed, or rendered the object of our senses. But, if we may judge any thing from analogy, and analogy was always reckoned a fair way of coming at the truth, we may venture to conclude it partly saline, and partly mineral.

The nature of this spirit.

THAT it is saline, seems probable from the fixed contents subsiding immediately upon its avolation; and we have already shewn, that a saline menstruum is the on-

ly thing capable of dissolving such bodies as are found to be contained in mineral waters.

THUS, not only artificial salt of steel which we know consists chiefly of a metallic part, corroded by an acid salt, diluted in common water, will make a tolerable spaw; but if, according to * Boyle, that great naturalist, ten parts of distilled vinegar be poured upon one part of clean filings of steel, and these two be set in a gentle heat for some time, they will yield a gold-coloured tincture, whereof four drops, with eight ounces of spring-water, will make an artificial spaw, not inferior to many natural ones of great repute, and hardly to be distinguished from them, either in taste or virtues.

This seems sufficient not only to induce us to believe that this spirit is saline, but likewise to give us a notion of the special nature of this salt, which in chalybeate waters appears evidently to be acid. Neither is it any argument against the truth of this, that no chalybeate water gives the least sign of acidity, torture it as you will, since

* Shaw's abridgment, vol. iii. page 517.

since, as is already shown, acids may lose their natures ; and, to confirm the thing further, the same is equally true of artificial spaws made of iron and an acid salt ; they seem rather to incline to an alkaline quality, by changing syrup of violets into a green colour, and have every other property of a genuine spaw ; so that as acids easily dissolve metals, and nothing else will dissolve earthy substances, and as all sulphurs readily yield a pure acid spirit, it is not improbable, that the impregnating salt of all mineral waters may originally be one and the same, though it afterwards appears to us under different figures, according to the difference of the bodies with which it happens to be united.

WHENCE this acid dissolving salt takes its origin, and how it comes to act upon these substances, we cannot, in my opinion, better account for, than from that vague, suffocating, sulphureous, acid vapour, so often met with in mines, and so dangerous to the workmen ; which, perhaps, is only an acid spirit of sulphur raised like the artificial one, by being set on fire. May not this acid vapour, flying about in the

The origin of this acid salt.

cavities

cavities of the earth, sometimes light on bodies which it is capable of dissolving, with which it may intimately unite, be fixed, and thus form an infinite variety of compositions perfectly dissoluble in water? With iron, it may produce a spaw, with earths, different waters, according to the nature of the dissolved ingredients, with a pinguious fossil, a sulphureous water, with the various mixtures of these different waters, according to the different proportion and combination of their contents.

This spirit
is likewise
partly mi-
neral.

THAT the volatile spirit is partly mineral is evident, because, in most medicinal springs, the experiments made upon the water at the fountain, and some time after it is taken up, do seldom answer the same proofs. We meet with many spaws, whose chalybeat is so exceedingly volatile, that after a few hours standing, the water which before gave evident signs of the presence of iron, by striking a purple with galls, will no longer give any such indication; so that when this unconfinable saline spirit, which gives energy to the whole composition, comes to evaporate, and fly off, it carries also with it a considerable

derable quantity of the more subtile mineral matter, which is so intimately united with the salt, as to become volatile with it, and inseparable from it.

HENCE we learn, how very difficult it is to acquire an adequate knowledge of the nature and quantity of all the contents of a mineral water.

The perfect knowledge of mineral waters obscure.

THE spirit indeed, or menstruum, may be always uniform, but the bodies dissolved by it, and flying off with it, differing so exceedingly, we must be at a loss to know what part, or how much of these last evaporate together with the spirit upon its avolation; and there seems to be no other way left us to form a judgment of these things, but by experiments made upon the waters themselves while freighted with these volatile particles, and by experiments made upon the same waters after they are deprived of them, to observe the difference of their appearance.

HENCE likewise are we furnished with an answer to an objection commonly made against the power and efficacy of mineral waters, that their contents are so few, that very little can be expected from them; since

The fewness of the contents of mineral waters, no objection to their virtues.

since the impregnated mineral, being for the greatest part rendered volatile, flies off with the spirit, and is therefore imperceptible to us.

Mineral
waters best
drank up-
on the
spot.

LASTLY, it appears from hence, that waters containing a volatile spirit, are always drank to the greatest advantage at the spring; daily experience confirms the truth of this; and it is highly reasonable to believe, that when the active principle is gone, the grosser parts are fitter to generate, than to remove distempers. It is therefore best to take them as nature has presented them to us, and provided them for us.

The way
to know
whether a
mineral
water re-
tains its
virtues.

THE surest way of discovering whether a mineral water preserves its virtues after it is drawn from the spring, is to examine whether it continues to have the same appearances, and answers the same experiments. Thus, if a water at the spring is hot, it undoubtedly loses a great part of its virtues as soon as it grows cold. If it was clear, and afterwards becomes turbid, it is good for nothing. If it in any wise alter in colour, taste, or smell, there is
sufficient

sufficient reason to pronounce it greatly injured in its medical virtues.

THE volatility of the saline spirit, the alteration from an acid into a neutral, or perhaps an alkaline nature, and the carrying of some metallic principles, is, I think, nowhere more clearly illustrated, than in the elegant experiment of Dr. Monro, the learned professor of anatomy in Edinburgh, which take in his own words.*

“ I mixed filings of iron, oil of vitriol,
“ and water in a Florence bottle, which
“ I laid on its side, and immediately fitted another to it in which I had put
“ some fountain-water. The fumes that
“ rose upon the effervescence of the oil of
“ vitriol with the steel, came over into the
“ other glass. After the violent effervescence was over, I took away the glass
“ with the water, which was quite limpid, but had a strong empyreumatick
“ smell; its taste was pungent at first upon the tongue, and then the acidulous
“ taste prevailed. When tincture of galls
“ was mixed with it, it became of a red
G “ purple,

* Medical essays, vol. iii. page 56.

“ purple, but faint colour, which held a
 “ great many days without any observable
 “ precipitation. Next morning, the em-
 “ pyreuma of the remaining water was
 “ gone, and it had a very agreeable brisk
 “ spaw taste: in less than a day after, this
 “ also went off; a small quantity of the
 “ saffron powder was fallen to the bottom
 “ of the glass, and the galls had no effect
 “ upon the water.”

Their fixed con-
 tents.

THE fixed contents are easily obtained, and rendered the evident objects of our senses. We find them as various as are the bodies capable of being dissolved in the watery element; and a careful examination and chymical analysis of these, will probably let us a good deal into the nature and properties of the waters impregnated with them. When, for instance, I find iron, salt, and sulphur, united together, and diluted in water, shall I hesitate in pronouncing such a composition proper to add new vigour to the stagnating blood, new strength and elasticity to the weakened vessels, capable of removing obstructions, and whatever may impede the free and easy operation of the animal machine?

Can

Can I not form a judgment in what cases they may be prejudicial, what preparations ought to precede their use, and, according to the quantity and quality of these contents, regulate their use and application, in proportion to the strength of the patient's constitution, and circumstance of his disease?

IT is of no weight to say, that because the mineral spirit is evaporated, and sometimes leaves a vapid insignificant water, the chymical analysis of what remains is only an useless piece of curiosity, and can contribute nothing towards illustrating the true virtues of the composition, or direct us in the right use of it; I readily allow, that the remaining water, after the loss of the volatile spirit, is often disagreeable, and even unwholesome, that the fixed contents of themselves, or even with the watery element, are generally of little significance to the obtaining the salutary ends for which such waters were intended. Nay further, we find that mineral waters, where they run off from the spring, do oftentimes leave an unconquerable ochre, or hard petrefactions on the adjacent bodies,

The chymical analysis of mineral waters not unnecessary.

whence some apprehend, the same effects may, in like manner, be produced in the animal fabrick; but these fears are vain. While the fixed contents are accompanied by the active volatile spirit, intimately dissolving them in the aqueous fluid, keeping them in motion, and diverting their attractive force, no such inconveniencies can happen. This argument serves indeed to prove the necessity of drinking such waters medicinally; that is, while the spirit remains, keeps the fixed contents dissolved in the water, and applies them toward the clearing of obstructions in the minutest passages. Besides, we may be assured, that this mineral spirit does not act contrary to, but in conjunction with the fixed contents. Such a supposition would destroy the benefit intended us by nature, and it would be contradictory to affirm, that what divides and attenuates any mineral, so as to render it capable of being carried through the smallest capillaries, should prevent its action and resolving power upon obstructed humours.

The small quantity of fixed contents in mineral waters no objection.

THE small proportion of fixed contents obtained from mineral waters, can be no reason

reason why a considerable part of their virtues should not be attributed to this cause, as some would insinuate, by telling us, that we might with much more ease, and equal safety, convey into the blood a greater quantity of the same, or the like ingredients. But herein, probably, consists the true virtue of such waters, that no preparation of art is capable of reducing these contents to the same degree of subtilty, as nature has done, in order to render them soluble in water. And supposing even that could be effected, where shall we meet with the like dissolving menstruum to unite them with the watery humours, and convey them to the remotest capillaries, where only they can be serviceable? Will they not probably be dropt in the first passages, and prove a clog, rather than a relief to distempered nature?

BESIDES, if we consider how much of the impregnated mineral is evaporated with the volatile spirit, what sensible contents do still remain, the quantity of water constantly drunk, how such a course ought to be pursued, and in how minute vessels the disorders

disorders almost always lye, for the removal of which they are generally applied; we shall easily be convinced how greatly we are indebted to nature for tempering them so justly, and proportioning their degrees of strength so exactly to our infirmities; since, if they were stronger, they would often plunge us into worse evils than those we would so carefully avoid. We even find that waters too much saturated with any mineral, become absolutely unfit for any internal use whatsoever. The waters of Bourbon in France, and those of Aix in Germany, are both of them much hotter than the Bath waters in Somersetshire. Yet, I believe, they were never put in competition with these last for the great effects, and surprising cures daily performed, under the direction of the learned physicians constantly residing there; who, by daily experience, and accurate observations, acquire a perfect knowledge of their proper use and application, and are constantly at hand to watch the various progress they make towards a cure, to obviate uneasy symptoms, and so to regulate their operation, that, according to the difference of
consti-

constitutions and distempers, nature may be duly assisted, neither suffered to grow languid and faint, nor be too much agitated or oppressed by the action and force of so active an impregnation.

THE last ingredient in mineral waters, Their element. is the element itself; which serves as a vehicle to convey the other two to the remotest extremities of the human body, and likewise, from the nature and quality of its own parts, contributes very considerably towards attaining the ends required. If we could, by any art, obtain a water absolutely free from all foreign mixture, we should probably have a medicine capable of effecting very great cures, so great is its tenuity, simplicity, mildness, and resolving power. What then may we not expect from a water impregnated with nothing but what, under proper direction, may be rendered highly beneficial, by effectually removing all those obstacles that may any way clog the springs of the human engine, and thereby render the circulation of the vital humours free, uninterrupted, and easy.

PURE

Water the
most flu-
id of all
bodies.

PURE water is one of the most fluid of all bodies, and the ultimate particles of it are so small, that it penetrates, and fills the finest vessels in the minutest animals. It is the basis of all the fluids in animal, as well as vegetable bodies, and without it, neither nutrition, nor augmentation, could ever be performed for these reasons; it easily reaches the most slender tubes, resolves cohesions, and clears the passages almost rendered impervious, especially when agitated by the action and heat of life, and much more, when it carries along with it other subtilized particles, which, by their figure and solidity, serve, like wedges, to attenuate and divide every viscid cohesion.

Mild, soft,
and heal-
ing.

WATER is likewise exceeding mild, soft, and healing, correcting the acrimony of the humours, and rendering them harmless and inoffensive to the human body. A drachm of oil of vitriol, taken by itself, would corrode, and destroy the stomach, but diluted in a pint of water, may be taken without danger, and sometimes administered with advantage.

HENCE

HENCE water, considered merely as ^{The vir-} such, by the tenuity, fluidity, and soft- ^{tues of} ^{waters,} nefs of its parts, is capable of opening obstructions, relaxing contractions, diluting the acrid particles of the blood, and dissolving its salts: but when impregnated with an active mineral spirit, and fraughted with other salubrious contents prepared by nature, and applicable to the same intentions; such a composition ought, with gratitude, to be looked upon as one of the greatest blessings the author of nature can bestow; and will, with due perseverance, and proper collateral assistance, infallibly produce all that can be expected without the preternatural assistance of a miracle.

I would not, however, be thought to ^{Every mi-} insinuate, as if every mineral water was ^{neral wa-} calculated to answer all intentions, and a- ^{ter not} dapted to the cure of every distemper, ^{applicable} though the common practice would almost ^{to every} persuade one to believe the generality of ^{intention.} people were of that opinion; who, running from one medicinal spring to another, and perhaps setting out wrong at first, lose both their money and their labour; and not seldom, from the injudicious use

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of such waters, find their maladies more confirmed, if not rendered incurable; like a bewildered traveller, who, mistaking his road at setting out, the further he goes, the wider he is from his point. A medicine misapplied, as certainly does hurt, as it would have procured benefit, if prescribed with judgment; so that one cannot be too cautious in his proceedings that way. It belongs to the physician only, both to judge of the necessity of the use of mineral waters, and to enjoin rules for the drinking of them to advantage. But as these must vary, according to the different circumstances of the constitution, distempers, and the qualities of the waters themselves, no general directions can be laid down that will suit every particular case. That affair must be referred to the candour and capacity of those whom the patient shall think fit to be entrusted with the guardianship of his health.

UPON the whole, it appears from what has been said, that the mineral spirit is the active principle, giving energy to the whole. That this spirit is compounded of
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the solvent salt, and more subtile parts of the impregnating mineral, so intimately conjoined, as by no art possible to be separated, but continuing to act with a joint efficacy when taken into the body: that if we cannot be positive as to the specifick nature, and exact proportion of this spirit, by reason of its volatility, yet we may be able to judge by our senses when it is present, and when absent, and, by analogy and experiment, discover its properties, as likewise its operation and effects upon the human body: that the fixed contents of themselves are generally of little significancy; but when united with this spirit, and dissolved intimately in the aqueous vehicle, are capable of producing the most salutary effects: that the action of these contents is analogous to that of the spirituous part, and therefore their examination both useful and necessary; so that we may, without any danger of imposing upon ourselves or others, readily pronounce the effects of the whole united composition, to correspond, in a great measure, with the known properties of the particular ingredients separately considered:

for though the proportions wherein mineral waters are mingled may be numberless, and the qualities resulting from such mixtures various, yet does this difference consist chiefly in the predominancy of one or more of the mineral contents, distinguishing itself by a prevalent action beyond the rest, and easily to be discerned by experiments on the water itself, or the chymical analysis of it into its compounding parts.



CHAP. II.

Of BRISTOL-WATER.



SECT. I.

The situation, &c. of the Hot-well.

THE Hot-well of Bristol is situated at about a miles distance <sup>Its situa-
tion.</sup> westward of that city, on the east brink of the river Avon, which runs here northwards between steep and craggy rocks, and after a course of four miles farther, empties itself into the Severn.

THE spring arises out of the solid rock, ^{Origin.} about ten feet perpendicular above the surface of the river at low-water, and discharges itself into it by a gradual descent; but

but the ordinary tides rising here to the height of near thirty, and the high springs to thirty six, or thirty seven feet, rendered the well for the most part inaccessible; till an ingenious artist * encompassed it with a cistern, which effectually guarded it against the influx of the tide, and, by a most admirable contrivance, fixed some curious pumps in it; so that the pure medicinal water is now raised almost thirty feet high to a cock, by an immediate communication, without loss of heat, or other its native virtues.

It is observed, however, that if they continue pumping after the tide rises something above the level of the spring, the tide-water then mixes with the other, and spoils its medicinal virtues; which seems to be owing to the weight of the tide-water exceeding that of the spring, and forcing it back towards its source; since, as soon as that force is removed, by the tide's falling a little lower, the spring begins again to preponderate, the medicinal water resumes its course, and quickly washes off any remains of the tide; whence

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* Mr. Padmore.

we may conjecture, that the natural receptacle of this water lies about that level. The well-keepers have learned, by experience, when to leave off pumping, and when to begin again, so as to be certain of having the medicinal water always pure and unmixed. This overflowing of the tide, however, generally prevents pumping for some hours every day, and obliges those who resort thither, and would drink the waters medicinally, to attend at the times when they may be drawn directly from the spring.

THE rocks on the same side of the river are called St. Vincents, from an old chapel that formerly stood near, dedicated to a legendary saint of that name. They rise to a considerable height, in some places almost perpendicular, in others unequally, and with an interrupted elevation. They consist chiefly of lime-stone of various sorts and colours, white, red, brown, grey, and black; especially that near the well, which, in some places, is of a deep black, and struck with a hammer, sends forth an intollerable fætor or stink, resembling the smell of a fox. Here likewise
are

The
rocks.

are found several strata of a fine dark brown marble, beautifully streaked with white and red veins, and admitting a polish equal to, if not exceeding most of that brought from Italy. The other side of the river is bounded by rocks of much a like nature, but more of the white sorts of lime-stone.

The adjacent soil.

THE soil upon the top of these rocks, and the adjoining downs, is a thin, warm, dry turf, or corn mould, lying upon limestone, and producing great variety of aromatick plants, such as heath, eyebright, wild thyme, marjoram, maiden hair, wild sage, geraniums, &c. which breathe forth a pleasant odour, and yield excellent pasturage for animals, whose milk is often necessary in the cure of many chronical distempers, and which, by this means, partakes of all the healing, balsamick qualities of such a diet. The warmth and fineness of the soil appears in the garden productions, which are hereabouts more early, and excel, in a grateful taste and flavour, any of the neighbourhood.

The air.

THE air, from the dryness of the soil, is free from all the noxious and pestilential

al vapours of stagnating waters, or marshy ponds, and by the elevation of the situation, is thin and pure, most delightful and refreshing in the summer, though sharp and piercing cold for some constitutions in the winter. Besides, the continual burning of the lime-kilns here, and the effluvia exhaling from the fragrant odoriferous plants, fill the air with healing, drying, vulnerary particles, which make it both salutary and desirable to the chronical patient, and render these downs convenient and agreeable every way, either for exercise or diversion.

WHEN, and after what manner the medicinal virtues of this water were first discovered, is equally uncertain. We only know, that almost a century ago, it was by physicians * prescribed for some of the same disorders for which it is now so universally recommended. But, whether owing to the want of a sufficient knowledge of its real qualities, or the vicinity of the famous medicinal springs at Bath, of whose virtues it has by some been thought to partake, or through neglect, it is not till

The antiquity of these waters.

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within

* Guidot Thermæ Britannicæ.

within half that time it has acquired so great a reputation both at home and abroad, as to be now ranked in the first class of medicinal springs.

Their perpendicular rise.

THE first thing observable of this water is, that it issues not forth in form of a stream, but arises perpendicularly out of the solid rock immediately to the day, bubbling up a living spring. From this, and from its not admitting a mixture of tide-water, it seems probable, that it has, in the rock above, some hollow cavern for its natural receptacle, where it receives its impregnation, and from whence the spring is continually supplied.

Its quantity discharged.

THE quantity that it affords I could not exactly calculate, as I could not easily contrive a method to save the whole stream for any given time; but, from the observation of some persons tolerably well acquainted with such affairs, it has been computed to discharge about forty Gallons in a minute, or 2400 gallons in an hour.

No petrefactions hereabouts.

I could not find that any recrementitious substances, or petrefactions, adhered to the bodies contiguous to this water, which
may,

may, perhaps, be owing to the daily overflowing of the tide washing off any such concretion.

NEITHER did I observe, that the seasons of the year, or vicissitudes of the weather, made any considerable alteration in the water, either as to quantity or quality; only sometimes, after long and immoderate rains, it appeared a little foul and turbid, but that never lasted above an hour or two, after which the water recovered its usual taste and warmth; which makes it probable, that this foulness was occasioned by the falling of rain-water through the clefts of the rock, and its meeting with the medicinal stream in the passage between the natural receptacle, and its appearance to the day. Had the receptacle itself been disturbed, the water could not so soon have recovered its former clearness and purity.

Not altered by the seasons.

ONE of the most remarkable properties, is the warmth of this water; which, by repeated trials, I found raised the mercury in Fahrenheit's thermometer to the degree 76. The alteration occasioned by the different weight of the atmosphere,

The heat,

never exceeded a degree. Now, the heat in a healthy person seldom exceeding the degree 96, it follows from this calculation, that the hot-well water is a little more than three fourths of the human heat. An adjoining spring sunk the thermometer from 76 to 50; which therefore, has but almost two thirds of the heat of the hot-well water.

Full of
air.

WHEN warm from the pump, it evidently contains a considerable quantity of air, which appeared in an infinite number of little bubbles, sparkling, and bounding through its substance, as if the whole had been in a ferment. These gradually disappeared and vanished, in proportion as the water cooled. Does it not from hence follow, that upon impregnation here was an effervescence or ebullition? Whence else should the heat proceed, or whence should the water imbibe this air?

Colour.

WHEN newly drawn, it is of a whitish colour. This it loses gradually as it grows cold; nor can it afterwards, by any heat of fire, ever be raised to the like colour again; which shews, that something very
subtile

subtile is contained in this water, unconquerable by any art.

THE taste is particularly soft beyond The taste. that of all other waters; only after drinking, it leaves a sort of stipticity or dryness upon the palat. It seems to be perfectly Smell. inodorous.

As to the specifick gravity, it did not Gravity. appear, either from the hydrostatical balance, or hydrometer, to differ considerably from common clear water. Several trials were made at the pump, where it weighed seven grains in a pint less than common water. The same quantity, after standing three days, weighed four grains less than it did at the pump.

IT afforded a sediment, or precipitate, Affords a
sediment. though cautiously guarded from being exposed to the air. A clear Florence bottle was filled with the water warm from the pump, when held between the eye and the sun; nothing could appear more transparent than it was, nor could the least atom be perceived. Next day, upon viewing it in like manner, one might easily discern innumerable atoms swimming through its whole substance. These grew daily sensibly

sibly larger, till they appeared like little flakes floating in the water, and were at last collected into a white sediment; which, upon shaking the bottle, was raised up, and disturbed the transparency. When this phænomenon is duly considered, no one, I presume, will venture to say, that the water, when kept, or after carriage, may be drunk with equal advantage as upon the spot.

Will not
dissolve
soap.

THE water, at the pump, or even after standing some days, would not dissolve the best soap equably, but curdled it into little white masses; neither will it wash linen, or extract tea, so well as common water; but, after it has been kept three weeks, it will serve these, and all other purposes, as well as the best common water. This remarkable difference must be owing to something which was contained in the water at the pump, and is afterwards separated from it in that time. It is either the most subtile part of the impregnation, which flies off with the volatile spirit, or it is the powder we now mentioned, which subsided in keeping, and which we shall hereafter find to be an astringent alkaline earth.

earth. It cannot be occasioned by the small quantity of salts dissolved in this water, since waters, much more strongly impregnated with salts of the same nature, will nevertheless dissolve soap easily.

THIS water was something longer in freezing than common water, and projected crystals more regular. This difference one might likewise observe, that when equal quantities of hot-well, and pure rain-water, were separately put into two tea-cups, and set to freeze, the icicles of the first began to shoot at the bottom of the cup; and when the water was quite frozen, there remained at the top about the thickness of one fifth of an inch of clear ice, without any crystal. Rain-water, on the contrary, began to freeze first at top, and formed all the particular crystals there, leaving, at last, about the same thickness of clear ice at bottom, as was in the other at the top of the cup.

Longer in
freezing
than com-
mon wa-
ter.

IF taken up carefully, put into clean bottles, and well stoppt, so as intirely to prevent the access of external air, this preserves its sweetness longer than any other known water, and probably would never

Never
corrupts.

never corrupt. The ultimate elements of water are incorruptible, as appears from the experiment made at Rome ; where the purest water, being poured into a clean vessel, and hermetically sealed, continued a whole age without any sensible alteration. Rain-water is properly the lixivium of the atmosphere, in which is contained an infinite number of corpuscles of all sorts that floated in the air ; but being strained through a rock of lime-stone, it there deposits all the heterogeneous particles it was before tainted with, is cleansed from the impurities of all animal and vegetable substances, and consequently can never undergo the alterations of putrefaction or fermentation. And as the hot-well water contains not the least quantity of fixed sulphur, or even volatile, as far as we can judge by taste, smell, or experiment, it will never change, or grow fœtid ; since, without the presence of sulphur, no fœtor is ever observed to be produced. If indeed this water is exposed to the air, it may become liable to the changes natural to the bodies it receives from thence ; but these
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are to be ascribed to such contents, and not to the waters themselves.

THESE are the most remarkable properties observable in the first consideration of Bristol waters; and from hence we see they consist of a pure element, impregnated with a soft, mineral-like substance; that they are endued with a reviving warmth, and replete with an elastick air. On these accounts, are they not only grateful and pleasant to the taste, but extremely well calculated for softening and relaxing all unnatural contraction and stiffness of the solids, correcting the acrimony of the fluids, moderating the violence of the blood's motion, allaying febrile heats, and cherishing decayed nature.

S E C T. II.

Experiments on Bristol Water.

The examination of this water.

BUT, in order to obtain a more thorough knowledge of these waters, and to examine more nearly into the qualities and proportions of their contents, we will consider next the experiments made upon the waters themselves, and then proceed to a chymical analysis of them into their compounding parts. By this means, we shall be better able to judge of their real nature, and establish a more reasonable foundation to assign the true cause of their virtues, and ascertain, in some degree, their proper uses in particular cases.

The intricate composition of mineral waters.

FOR though it must be allowed, that mineral waters are so nicely compounded by nature, that it is impossible, by the most accurate analysis, ever to come at the exact proportions of their impregnation, some parts being volatile, and never to be fixed, while others, in the chymical
opera-

operation, undergo, perhaps, such changes, as never to be obtained separate, exactly the same they existed in the compound; yet must this method be looked upon as a good collateral assistance, informing the physician of their nature, degree of strength, and medicinal virtues. And though experience, in the use of remedies, undoubtedly claims the first place, yet are other helps not to be neglected. Experience may deceive us. Hippocrates * owns it did him. Neither is it sufficient for a physician to understand the patient's constitution and disease, he must likewise be thoroughly acquainted with the nature and power of his medicine, otherwise he may happen sometimes to make but an indifferent application.

FIRST then, trials were made with the water at the pump, and likewise after it was cold, and had stood some days, by adding to it variety of acids, alcalies, astringents, and other mixtures, and observing the effects from their affusion.

SECONDLY, the water was evaporated to a dryness, in order to obtain the fix-

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* *Experientia fallax.* Hipp aph. 1.

ed contents, upon which the same experiments were repeated.

THIRDLY, the residuum was analysed into the different compounding parts, in order to a separate examination, both of their qualities and proportions.

Experiments on
the water
with astringents.

I. GALLS in tincture and substance, pomegranate, bark, oak-leaves, and green tea, produced no alteration in the colour of the water at the pump, nor after it had stood three days. Whence there seems to be no room to suspect the least quantity of dissolved iron (or vitriol) either volatile or fixed, in this water, since every steel spring always gives a deeper or lower purple, with these, or other astringents.

Lixivial
alkalies.

WITH a lixivial alkali, as oil of tartar per deliquium, a bluish white colour was immediately formed in a cloud, which gradually dispersed itself through the whole. In six hours there was deposited a light white sediment at the bottom of the glass, and the water above was clear. If the glass was held between the eye and the light, one might, upon the affusion of this oil, perceive a very sensible fermentation

tion with a generation of air. Some may fancy this sediment to be the sulphur contained in the water; but oil of tartar, with the pure saline liquor obtained from this water, yields both a cloud and a sediment; so likewise poured into a solution of nitre and sea-salt, it forms a cloud of the like resemblance, and these we shall afterwards find to be the only salts contained in this water.

VOLATILE alcalies occasioned very little change in the appearance. Spirit of hartshorn, and spirit of sal armoniack heightened the colour a little after three days.

Volatile
alcalies.

MINERAL and vegetable acids, as oil, and spirit of vitriol, Glauber's spirit of salt, oil of sulphur by the bell, and distilled vinegar, raised a brisk fermentation, with bubbles of air sparkling up and down, which were in a short time collected to the sides of the glass in great abundance. At the same time the water lost its whitish colour, and became more transparent and clear. Is not this something analogous to its first impregnation, the acid mineral salt intimately dissolving the alkaline earth, raising fermentation and heat, and generating air?

Acids.

WITH

Solution
of subli-
mate.

WITH a solution of sublimate there appeared no manner of change, which to me seems to be a convincing proof, that the salt contained in this water is no alcali, either volatile or fixed. Had it been a volatile alkaline salt, a white precipitate would have immediately subsided, as we see happens, when a few drops of spirit of sal armoniack are poured into such a solution. Had there been any fixed alcali in it, a red sediment would have fallen to the bottom, as it does with oyl of tartar.

Solution
of silver.

A solution of silver in Glauber's spirit of nitre, changed the water immediately into white, with a large white cloud quickly subsiding to the bottom of the glass.

Solution of
mercury.

A solution of quicksilver turned it into a deep yellow, and let fall a large sediment of the same colour.

Solution
of sugar
of lead.

A solution of sugar of lead caused a very white cloud, which in an hour adhered to the bottom and sides of the glass, and was then of a dusky white colour. These three experiments answered exactly the same with a solution of sea-salt well depurated.

WITH

WITH Mynsicht's tincture of steel there appeared no signs of fermentation, neither was the water any otherwise changed than common water upon the like affusion. This seems to deny the existence of all manner of sulphur here.

Tincture
of steel.

TINCTURES of logwood and fustick produced no other effects than they did with common water. No more did syrup of clove gilliflowers.

Tinctures
of log-
wood and
fustick.
Syrup of
cloves.

SYRUP of violets changed the water into a beautiful green; an evident proof that therein is contained some sort of alkali. That it is not the salt, some of the preceding experiments abundantly testify; there remains then, that it be the alkaline earth, which will be made appear plainer when we come to shew, that the earth, intirely separated from the salt with syrup of violets, produces a green colour, and that the salt by itself has no such effect.

Syrup of
violets.

ALL these experiments were repeated on the water, after it had been kept in well corked bottles, carefully sealed thirty days. The effects were analogous, but not near so strong. There was no perceptible fermentation occasioned by the affusion of
alcalies

alcalies or acids, no generation of air. Oil of sulphur subsided to the bottom of the glass, and did not mix till well shook with the water.

THE same trials were made on several of the adjoining springs, and the waters issuing out of the neighbouring rocks. They were all cold but one (the new hot-well) and all partook of the same qualities, though in a much less degree. But the same effects were in vain looked for from the like experiments upon common water, or upon rain-water received on an eminence in a pure air; so that it is very plain, these tepid waters, besides their greater heat, differ considerably from common water, and are impregnated with some principles of a particular and distinguishing nature, which may be partly understood from the foregoing experiments, but more clearly illustrated by the second method proposed, viz. evaporation.

This water very different from common water.

The quantity of fixed contents.

2. ONE gallon * of this water newly drawn, evaporated to a dryness in a cylindrical

* The gallon here mentioned, contains 231 cubick inches, and in common clear water, weighs 58485 grains Troy weight.

lindrical vessel, over a gentle fire, in a clear place, in eight hours, yielded thirty four grains of a grey powder, saltish, and pungent to the taste. This is the whole fixed contents, whose proportion to the aqueous vehicle, is as 1. to 1720.

IT is impossible to be so exact in the operation, but the quantity will differ something upon each trial, on account of the fire, the vessel, or other accidental circumstances: this difference, however, is only in quantity, and makes no alteration in the chymical examination ; nor is there any room to suspect it owing to the different strength of the impregnation at different times ; since, in proportion to the nicety and care used in the evaporation, the quantity of the remains comes always nearer the same.

DURING the evaporation, the water begins gradually to lose its pellucidity, and together with the rarified element, there arises in steam a white impalpable powder, which becomes visible, by adhering to the sides all the way from the surface of the water to the mouth of the vessel ; while

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the

the heavier, and more gross particles, fall to the bottom in a coarser powder of the same colour. This sediment increases in proportion as the water exhales, and the interstices wherein it is lodged, become thereby diminished.

WHEN from sixteen quarts it had boiled away gradually to less than one, it tasted saltish, and inclined something to a whey colour. When farther boiled, to about half a pint, there remained a strong briny liquor. This was carefully decanted off, and at the bottom was left a powder, which, gently dried on a tea-plate before the fire, proved a white mere insipid earth. By this, we see that the whole salts contained in four gallons of this water, remained dissolved in six or seven ounces of water, after almost all the terrene particles were dropt.

Experiments on
the whole
fixed contents.
With acids.

THE experiments made upon the whole remains, were the following.

OIL of vitriol caused a strong ebullition, and a hissing noise with them: so did oil of sulphur, distilled vinegar, and juice of lemons; the colour became likewise more dusky, or brown. Here we may observe,

observe, that these ingredients, when united together, and brought within the sphere of attraction, act with greater force, and cause a much more violent fermentation with acids, than they were capable of doing when dispersed in the water, and kept farther asunder.

OIL of tartar per deliquium occasioned no change: no more did spirits of hartshorn, sal armoniack, or any other alcali.

SYRUP of violets immediately produced a beautiful green.

WITH Mynsicht's tinure of steel, there was no appearance of any fermentation; nor yet when the remains were rubbed well with filings of steel, depurated by a loadstone, and made up into a paste with water, which would have happened, had any fixed sulphur been there.

A solution of sugar of lead poured upon the remains, increased their white colour.

A drachm of the remains put into a crucible red hot, and kept in a goldsmith's furnace during ten minutes, at first crackled a little; then melted, boiled, and blebbed; at last, was calcined into a concrete

substance, very acrid, and with great difficulty separated from the bottom of the crucible. It had lost in weight thirteen grains.

Distillation.

THE remains obtained from a gallon of water by distillation, could not be brought to re-unite with the distilled water, so as to form an homogeneous transparent liquor, as before. The salt immediately dissolved, but the earthy powder soon fell to the bottom; whence may be concluded, either that these ingredients are not obtained the same as they existed in the natural mixture, or else, that in evaporation some particles are lost, and the uniting medium, which rendered the whole dissoluble, is gone; the last seems most probable. Thus we see the experiments made upon the whole residuum, answer pretty near the same with those made upon the water itself.

The analysis of the fixed contents into salt and earth.

3. IN order to analyse the remains into their compounding parts for their separate consideration, two drachms of the whole fixed contents were mixed with four ounces of very pure warm rain-water: the mixture was troubled, and tasted briny; when
put

put to filter, the briny part passed clear with the water, and left the insipid terrestrious part behind. This last, carefully collected and dried, weighed sixty seven grains and a half, and the saline liquor, gently evaporated, yielded forty nine grains of a very white salt, in both $116\frac{1}{2}$ grains; so that in the operation $3\frac{1}{2}$ grains were lost; from hence it appears, that the salt is to the other parts near as 11 to 15, making some small allowances for the unavoidable loss of a few parts.

THE earthy tasteless powder resembled levigated pearls, and exhibited these phænomena.

Experiments made upon the earthy parts. With acids.

WITH acids, an ebullition and violent fermentation, with a hissing noise.

WITH oil of tartar, spirits of hartshorn, and sal armoniack, no change.

Alcalies.

WITH solution of sublimate mercury, sugar of lead, and tincture of steel, no change.

Sublimate mercury and steel.

WITH syrup of violets, a green colour, but something paler than with the whole remains, was produced. Syrup of gilliflowers made no change.

Syrup of violets and cloves.

WHEN

Calcined.

When put into a red hot crucible, it sparkled a little, but neither melted nor flamed. After being kept in the fire ten minutes, it had lost very little of its weight, but was become a hot acrid powder, which in a moment changed both syrup of violets, and syrup of gilliflowers into a deep green; notwithstanding this, when viewed in a microscope, there was not the least appearance of salt.

Figure.

THE insipid powder, when examined by the help of a very good reflecting microscope, appeared to consist of particles, scabrous, spongy, and opaque of very different figures.

THESE experiments are sufficient to convince us that this earth is alkaline, and that the green colour communicated to the syrup of violets, is no ways owing to the salt, but to the earth altogether.

The salt
of Bristol
water two-
fold, ni-
trous and
marine.

WE come now to consider the salt remaining after evaporation of the aqueous part of the briny liquor. It was of a white colour, and of a strong pungent taste. When viewed in the microscope, it appeared to be a confused heap of saline particles of different figures, with
some

some earth intermixed, which rendered the others less distinguishable.

THEREFORE, that I might obtain the salt as pure as possible, I had ten gallons of the hot-well water boiled away to twelve ounces; this was filtered, and afterwards evaporated to about one half, which began to have a scum or pellicle on the surface. It was then set in a cellar to shoot, and in three days there was formed a pillar of salt above an inch long, and $\frac{1}{4}$ of an inch broad, consisting of a vast number of slender hexagonal prisms, laterally applied to each other, and extending the whole length. A small bit broke off one of these prisms, shewed in the microscope fine, transparent, regular, longitudinal crystals, denoting nitre: there were likewise a few small cubical crystals adhering to the sides of the nitrous prisms, and some almost round, here and there interspersed.

WHEN a little of the pellicle was placed in the microscope, there appeared great plenty of cubical crystals, with some longitudinal ones intermixed.

THE

Cubical
dyes.

THE liquor, after the formation of the nitrous pillar, tasted still very pungent, and like a solution of marine salt. It effectually proved to be so; for after standing a few days, and the exhalation of some part of the watery fluid, there fell to the bottom a salt powder, of which a small quantity placed in the microscope, appeared to consist chiefly of cubical dyes, some nitrous crystals, and likewise some earth.

THUS we see the fixed salt contained in the Bristol waters, is neither acid nor alkaline, but for the greatest part nitrous, the rest marine. It is impossible to calculate the exact proportion of each, neither would it serve any purpose to know it.

Experiments on
the salts.
On the
nitre.
With acids and
alkalies.
Syrup of
violets.
Sublimate.

EXPERIMENTS were next tried upon each of these salts separately, first upon the nitre.

No fermentation was occasioned by the affusion of acids or alkalies.

SYRUP of violets was no ways changed, nor a solution of sublimate mercury.

Sugar of
lead.

A little of it dropped into a solution of sugar of lead, produced an exceeding white colour, and a white powder subsided to the bottom.

UPON

UPON a red hot iron it immediately liquified, but neither flamed nor smoaked. In a hot iron.

I caused a hot iron to be brought near it while I viewed it in the microscope, and observed how the crystals gradually lost their figure, and seemed to be dissolved, or rather converted into a transparent liquor. In a little time after the hot iron was removed, they again became visible, and recovered their pristine figure. These experiments were made upon this salt soon after it had crystallised. A small quantity of it I kept for two months in a dry place; the external surface began to lose its transparency, and some part of it was reduced to a very white salt powder. I put the whole into a red hot iron spoon, and it remained fixed in the fire for half an hour, without any other alteration, but the total loss of its pellucidity.

SOME of the nitrous salt I dissolved in pure water, and with the solution repeated most of the same trials. It neither turned syrup of violets green, nor formed a cloud with oil of tartar. With solution of sublimate it at first made no change,

M

but

but in half an hour the mixture became whitish.

Experiments on the marine salt.

THE muria remaining after the projection of the nitrous pillar, could not be brought to crySTALLIZE; it was therefore evaporated, and there remained a pungent white salt.

With spirits and acids. Calcined.

WITH this neither acids nor alcalies fermented, only it seemed to imbibe spirit of vitriol with some greediness. Put upon a red hot iron, it swelled a little, and crackled.

Experiments made upon the saline liquor.

BUT least the fire in evaporation should any ways have altered the salt, some of the muria was passed twice through the filtre. With this I made the following trials.

With oil of tartar.

OIL of tartar dropt into it, caused a white cloud, or rather a coagulation into little white masses swimming about.

Acids.

WITH acids there was no visible change, nor with a solution of sublimate.

Sugar of lead.

WHEN poured into a solution of sugar of lead, there was formed a thick white cloud, which soon precipitated.

Silver.

WITH a solution of silver in spirit of nitre, there was likewise a white cloud and sediment.

WITH

WITH syrup of violets no change.

Syrup of
violets.

HENCE we see there is not a grain of alkaline salt among all these, otherwise it would have discovered itself, by turning a solution of sublimated red, as all fixed alkaline salts do.

LASTLY, the separate solutions of the nitre and remaining salt, were mixed together, and passed through the filtre, in order to try the effects of all the salts united.

Experiments upon the solution of both salts united.

WITH spirit of hartshorn there was instantly formed a whitish cloud, which quickly dispersed itself equally, and dropt a sediment of the same colour.

With spirit of Hartshorn.

WITH acids there was no sensible fermentation, and with a solution of sublimated there was produced no change.

Acids. Sublimated.

WITH oil of tartar raised a bluish white colour. Syrup of violets was not the least altered after two days.

Oil of tartar. Syrup of violets.

THE solutions of silver, and sugar of lead, became very white, and yielded large sediments of the same colour.

Silver and Sugar of lead.

A solution of nitre and sea-salt, produces exactly the same changes and ap-

pearances, which is a further confirmation, that these two only, are the impregnating salts of the Bristol water.

AND it appears by all these experiments, upon the whole contents, upon the earth alone, upon the salts and their solutions, separately, and together, that every appearance of alcalinity in this water, is intirely owing to the earth contained in it; which only fermented with acids, and turned syrup of violets green.

S E C T.

S E C T. III.

The earth of Hot-well water.

IT remains now that we enquire into the particular nature of this alkaline earth, so subtile and fine, that no art can imitate it; and to which, probably, the celebrated virtues of these salubrious waters may be chiefly attributed. Of the alkaline earth.

THE adjacent rocks, and neighbouring hills, consisting almost of nothing else but lime-stone of various sorts, it is not unlikely that this earth should partake a good deal of the same nature. Add to this, that spirit of vitriol, or any other strong acid poured upon powdered lime-stone, produces a sensible fermentation, and a little heat, and that some part likewise of its substance is at the same time dissolved. Its nature.

IT is true, no artificial composition can pretend to emulate natural productions; but is there not some reason, from what is said, to suspect, that the volatile native How dissolved.

native acid spirit, flying about in the caverns of the earth, and meeting with a bed of lime-stone, may corrode some part of it to a point of saturation ; and that this corroded substance, the united mixture of the acid and lime-stone, may be easily dissolved by such waters as happen to fall that way, and thus afford a limpid, and almost insipid liquor, richly impregnated with these contents ?

As long as the acid remains united with, and adheres to the lime-stone powder, so long will the water retain its transparency ; but if any part of it happen to be volatile, and fly off, the dissolved body will, in proportion, immediately precipitate, and fall to the bottom. This impregnating spirit is probably scarce ever to be met with absolutely pure and unmixed ; so that it is not to be wondered at, if some other particles, floating in the acid fluid, be likewise joined to the lime-stone, and, by this means, make some difference in the nature of such waters. The acid seems, however, to be the principal agent without which the other ingredients could never be dissolved.

BUT

BUT although the alkaline earthy part of this tepid water consists chiefly of lime-stone powder, it is not from thence to be inferred, that this water is of the same nature with common lime-water, or that it owes its heat to actual fire, or the igneous particles contained in calcined lime-stone.

Not the
same with
common
lime.

SOME, I know, think so; and indeed the first view of the situation of the place, the surprising cleft between the rocks where this spring arises, and the Avon now runs; the corresponding convexities and concavities answering each other on both sides, in those places where the workmens tools in digging for lime-stone have not defaced their natural figure; an antient tradition, that the river had formerly another course into the Severn, till an earthquake opened a new passage for it through the disjointed rocks: all these circumstances, I say, would at first incline one to acquiesce in that opinion, and to believe, that in former ages a subterraneous fire had at that earthquake calcined a large bed of lime-stone, over which a stream of water continually running, gradually dissolving some part,
thus

thus acquired heat and other properties, and flowed out a true natural lime-water.

NOTWITHSTANDING the seeming fair appearance of this notion at first sight, we shall, upon better enquiry, find it intirely without foundation; for, besides the improbability of such an earthquake, and the uncertainty of the tradition, experience furnishes us with unanswerable reasons to the contrary, and discovers a very essential difference between this and common lime-water. This will appear best by analogy and comparifon, by which we shall plainly see wherein these two waters agree, and wherein their chief difference consists.

The difference
between
Bristol
water and
Lime wa-
ter.
By expe-
riments.

LIME-WATER, after evaporation, yielded no fixed salt of any kind that I could observe. Bristol water contains both nitre and sea-salt in a sensible quantity.

LIME-WATER is fiery to the taste, more stiptick, and sweeter than Bristol water; it likewise curdles soap water much more than Bristol water does.

LIME-WATER, with oil of tartar, became much whiter than Bristol water, and instead of a sediment, had large white flakes,

flakes collected, and swimming on the surface.

WITH tinctura martis mynsychti, lime-water was immediately changed to a deep red, and deposited a sediment of the same colour. Bristol water, with such a tincture, suffered no other alteration than common water.

A solution of sublimed mercury added to lime-water, turned it into a deep yellow, with a large yellow sediment. The same solution with Bristol water made no change.

WITH tincture of logwood, a deep purple, or rather black, was produced, which gradually curdled into a blackish sediment. The same tincture with Bristol water, made only a diluted red, as common water would have done.

WITH spirit of hartshorn and sal armoniac, there appeared no manner of fermentation, or generation of air. Bristol water with these occasioned both.

WITH a solution of saccharum saturni, there was produced a troubled white. Bristol water, with the same solution, formed

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ed

ed an equable cloud, which gradually fell to the bottom.

WITH syrup of violets it caused a deeper green than Bristol water did.

WITH syrup of clove gilliflowers it was changed immediately into a green colour. Bristol water only diluted the natural colour of the syrup.

From their
different
uses.

THESE comparative trials sufficiently evince the disparity of the two waters; and, to confirm it the more, we find, by experience, that though in some particulars they may agree, yet in others they are as different in their uses, as they are in their natures. The long continued use of lime-water, will sometimes occasion hemorrhages, and spitting of blood, and cannot fail of doing mischiefs in hot bilious constitutions, and acute distempers, being destructive to the tender excoriated nerves, and rendering the soft salts of the body acrid, fiery, and poisonous. Bristol water, on the contrary, corrects all acrimony of the blood, allays preternatural heats, and is serviceable in all disorders attended with burnings.

BUT

BUT to make the matter still clearer, I By calcination. took some of the residuary alkaline earth, perfectly freed from all the salt, this I calcined in a crucible for a whole hour. It was fixed in the fire, and wasted nothing. When cold, and poured out, though before quite insipid, it had now acquired a hot igneous taste, like unslacked burnt lime; and, like it, turned syrup of gilliflowers green, solution of sublimate yellow, and tincture of logwood purple; which, I think, puts it beyond contradiction, that the alkaline earth of Bristol water is chiefly crude lime-stone dissolved, and rendered nuscible with water, and not at all the lime-stone calcined by fire.

FROM what has been said, it appears evidently, I think, that there is a volatile spirit contained in the Bristol waters at the pump, which soon flies off in keeping, and carries along with it the finest and most subtile part of the mineral matter: that the more fixed contents consist of nitre and marine salt, and of a calcareous earth, intimately united in a certain proportion.

IT is now time to reduce our observations into practice, by applying these dis-

coveries towards illustrating the true, use, and extent of the virtues of this water in the cure of chronical diseases. Whether the reasonings be just, or are carried beyond what the evidence of experiment will warrant, or no, is not very material ; as the experiments themselves are true, every one may from thence draw what inferences he pleases, and form for himself a theory more agreeable to his own way of thinking.



CHAP. III.



SECT. I.

Of diseases acute and chronical.

THE body of man is an organick machine, consisting of solids and fluids, so combined together, as to form an intire system, and jointly to concur in the production of certain operations, termed animal functions. The corporeal system.

THE solids are chiefly pipes of different sizes, containing fluids which move through their cavities by certain laws, and for certain determined purposes. The larger pipes appear to be made up of lesser ones, so joined together, or interwoven, as to form at first a membrane, afterwards, by Its vessels.
circum-

circumvolution, a canal or vessel. The lesser are made up of others still less, and so in a gradual subordination to the least of all, whose sides are probably composed of elemental fibres, or solid threads.

Its humours.

To this indefinite series of vessels are the fluids both in size and consistence, by wise appointment, nicely adapted: for, notwithstanding the seeming homogeneity of the blood's appearance when first extracted, we may soon, by the naked eye, and much better by the help of glasses, discover a great diversity of parts in its composition; which makes it probable, that there as many different degrees of particles in the blood, as there are of vessels in the body, and that they are mixed and circulate in this manner. In the first, or largest rate of vessels, is contained the whole mass of blood. The second, whose diameter is too narrow to admit of a particle of the first magnitude, contains an aggregate of all the inferior orders. The third excludes both the superior orders, and admits only those of a degree still less; and so on to the last, which is proportioned for the reception only of the
most

most subtile and refined of all the animal humours. Is not this the nerves?

THE ultimate fibres, in their found state, are endued with a certain tone or elasticity; that is, they have a faculty of yielding without rupture to a bending force, and a power of recovering their pristine situation upon its removal. By virtue of this energy, these fibres would naturally contract themselves into strait lines, were they not prevented by the action and resistance of the contained fluids, distending and lengthening them into a parabolical figure. Thus are they kept as it were in a state of violence, there being a continual struggle between these two opposite powers, the one labouring to lessen the diameter of the vessel, and bring its sides nearer to the axis, while the other endeavours all it can towards its dilatation.

HENCE the magnitude and capacity of a vessel depends not on the contraction of the containing fibres, nor on the distention of the contained fluids alone, but on both united; which contrivance is not only admirable in speculation, but absolutely necessary

The elasticity, or tone of the fibres.

The magnitude of a vessel.

necessary for the keeping up of the circulation, and promoting all the animal secretions, as anatomy and mechanical knowledge more fully demonstrate.

An equilibrium
between
the vessels
and their
contents.

AND hence it appears evident, that for the conservation of health, there ought to be always a just and due proportion kept up between the force of these antagonists. As long as the solids continue capable of acting sufficiently upon the contained fluids, and these again of re-acting upon them, the circulation will be duly carried on, and all the functions regularly performed; so that nothing further seems wanting to constitute that state we call health. But if this equilibrium is lost, and one of these powers begins to predominate, a disease immediately ensues. Such likewise is their mutual relation, that one cannot be long affected without the other's participation.

Rigidity.

IF the elasticity of the vascular fibres be disproportionably increased, the sides of the vessels will contract more violently upon their contents, the blood's motion will be increased, some of the larger order of particles may be driven into the mouths of
the

the smaller vessels of less resistance, and the humours changed from their natural soft state, into an acrid exalted one ; hence fevers, inflammations, hemorrhages, frenzies, &c.

IF, on the contrary, the elasticity of the solids be diminished, and the distending force of the fluids have the ascendant, the capacity of the vessels will be enlarged, their fibres stretched beyond their natural tone : they become relaxed, and cease to contract as usual upon the contained fluids ; whence stagnation and corruption of the humours, obstruction and rupture of the vessels, defect of nutrition, and diminution of all the natural secretions.

WHEN the loss of the equilibrium is great and sudden, has a quick and violent tendency to destruction in a short time, the distemper is called acute ; but if this disproportion is gradually, and by slow degrees introduced, and, perhaps, from an inconsiderable beginning, increases to a great inconveniency, or the endangering the whole system ; a distemper thus occasion-

Relaxation.

Acute distempers.

Chronic.

ed from its duration, obtains the name of chronick.

Their
cure.

AND as the original of these two is different, so likewise must their method of cure be. Acute distempers, as they are suddenly acquired, as they threaten immediate danger, and quickly terminate in death or recovery, are to be combated by the prudent administration of such means as will produce an immediate change, and speedily alter the present fatal tendency. Chronical diseases, as they are more slow in their course and consequences, afford more time and leisure for the gradual restitution of decayed nature. This is particularly to be attended to in the treatment of chronical disorders, that through length of time both solids and fluids become generally depraved; and therefore, both are gradually to be amended, in order to preserve the necessary equilibrium. For, in a case where both are extremely weakened, if the solids should all of a sudden acquire their full vigour and power of contraction, the humours remaining uncorrected, what would follow, but the consequences of too elastick a state? Or, if the fluids were at once corroborated,

would

would there not be reason to apprehend all the mischiefs attending a predominancy of the humours over the containing vessels? Either way the equilibrium is lost; and, for want of a due attention to this, not a few have been disappointed of a promised cure. Every one knows the virtues of steel, bitters, and aromatics; that they are among the chief strengtheners, all allow; yet these, if imprudently directed for a person reduced to extreme lowness, by the sudden change, and by increasing the contraction of the vessels, would unavoidably precipitate the patient into worse and greater inconveniencies than those he would avoid; as hemorrhages, dropfies, and other often incurable distempers: whereas, had proper regard been had to the preserving equilibrium, and had the blood been amended proportionably as the solids were strengthened, health would by degrees have been surely recovered, a firm constitution acquired, and all danger of a relapse effectually prevented.

S E C T. II.

The causes of chronical diseases.

The causes of chronical distempers two-fold.

CHRONICAL diseases in general owe their beginning to one of these two causes, some error in the use of the non-naturals, or the dregs and impurities left in the body, after the imperfect crisis of an acute distemper.

Intemperance.

IN an irregular use of the non-naturals, the aliments designed for the constant reparation of those parts, which by the indispensable actions of life are wasting continually, become no longer assimilated or converted into the human body, but either remain crude and unconcocted, or degenerate and corrupt. Hence a depravation of both solids and fluids, defect of nutrition, a total bad habit, or universal cachexy, is insensibly introduced; consumptions, dropsies, atrophies, scurvies, and variety of other distempers spring up from the same source.

IN

IN an acute distemper, when nature, A fever. through the violence of the disease, or want of proper assistance to promote her endeavours, is unable to accomplish a perfect recovery, by a compleat coction and expulsion of the morbidick matter, some part thereof often remains dispersed through the whole habit, or by an imperfect crisis is deposited upon some particular part of the body. If this unconcocted matter remains dispersed through the habit, it disposes the patient to relapses, or at least febrile heats, proceeding from the frequent struggles of nature, to throw off the offending humour, which breeds and increases upon every occasional error in the use of the non-naturals. Such inconveniencies often happen when a sudden check is given to the fever, (the means nature makes use of for its own relief, and which the physician is not to remove, but to moderate.) In this case, the unresolved matter continues impacted in the obstructed vessels, the animal functions are impaired, the patient is left in a languishing condition, and obliged, for relief, to have recourse to change of air, exercise, bitters, mineral

mineral waters, &c. Whereas, had nature been properly ministred unto, neither left to languish, nor suffered to exceed, she would by degrees have wrought a perfect cure, and little afterwards would have been wanting but a proper regulation of diet, a good appetite being always a certain consequence of a thorough recovery from an acute distemper. The reason of which seems to be, that the body having been exhausted during sickness, and the vessels cleared of all impurities, a frequent and speedy supply is required to fill them again, and replenish what is lost. By too great indulgence in such cases, are crudities often engendered.

BUT if the febrile matter happen by metastasis to be deposited upon some particular part of the body, there is then produced a new distemper peculiar to the affected part. Thus if it fall upon the lungs, it may cause a vomica or consumption; if upon the liver, a jaundice and consumption of another sort; if upon the glands, schirrous tumours; upon the lymphatics, a dropfy; upon muscular parts, abscesses: all which, and many more,

more, are often observed to be the unhappy relicts of acute distempers, when a perfect coction and discharge of the morbid matter cannot be obtained.

BUT the more immediate cause of Obstructions, chronical diseases, or rather the consequences of these now mentioned more remote causes, are obstructions, which happen when the fluids cannot have a free passage through the vessels appointed by nature for their conveyance, and the animal functions are by that means interrupted. Sometimes the fluids are in fault, sometimes the solids, and sometimes both.

THE fluids may err either in quality or quantity. The fault of the fluids.

WHEN the humours grow fizy, and have their surfaces enlarged by coagulation, coalition, or viscosity, they become unfit for circulation, especially in the smaller vessels, and glandular circumvolutions, where the blood's motion is slowest; and the mutual attraction between the vessels and their contents, and between the contents themselves, is greater in proportion than in the larger canals. In quality. Their size.

OR,

Figure.

OR, when they recede from their natural figure, become acrimonious, and by their pointed angles corrode the solid fibres, irritate them into violent contractions, stop the narrow passages, causing inflammations, eruptions, scurvies, ulcers, cancers, perhaps rheumatisms and gouts.

In quantity.

Inanition.

THE fluids may likewise err in quantity, and be too few from inanition, the vessels will no longer be sufficiently distended, motion will grow languid, the humours stagnate and coalesce, and the parts be deprived of their proper and accustomed influx.

Plethora.

OR, they may be too many; then will the vessels be distended beyond their natural dimensions, the contraction of the fibres increased in proportion, the motion and velocity of the blood augmented, and an acute distemper be produced; or else, by an over distention the tone of the fibres will be destroyed, their action prevented, and so stagnation, cohesions, and obstructions succeed.

The fault of the solids.

THE solids may be weakned, relaxed, and become unable to propel the contained fluids, and, by this means, neither a due circu-

circulation will be kept up, nor the necessary secretions be performed; whence stagnations, corruptions, indolent tumours, dropfies, diabetes, leucophlegmatics, cachexies, &c.

OR, they may become too rigid and elastic, not yielding sufficiently to the impression made upon them by the blood, and hindering the intire evacuation of the heart; whence arise often palpitations, polypus's, marasmos, and dry atrophy.

THE defect of both fluids and solids may concur in occasioning obstructions, and, by that means, render the disease complicate; and this, probably, is often the cause the solids cannot subsist, nor be nourished, but by the fluids; neither can these last be kept in a fluid and sound state, without the action of the solids. A viscosity of the blood, if it does not begin with, at least ends in an acrimony. Viscidity causes a stagnation; by stagnation the humours corrupt, and grow acrid.

The faults
of both
united.

BUT among all the antecedent causes of chronical diseases, no one is more frequent, nor more fruitful in producing such

P maladies,

maladies, than the irregularity or interruption of due and proper secretions, which are as requisite to life and health as the circulation itself.

By the laws of the animal œconomy, there are separated from the mass of blood as many fluids of different orders and magnitudes, as there are vessels in the body; this is absolutely necessary for the exercise of the animal functions. There are likewise particular organs, with a proper apparatus of vessels, for the preparation and secretion of certain humours, appointed for particular purposes, and which can no where else be effected. The bile, for instance, cannot be separated but in the liver; the saliva, by the glands of the mouth; the mucus, semen, pancreatick juice, lachrymal humour, &c. by their proper organs. All these different humours must therefore, virtually at least, exist in the blood, and, in order to the preservation of its due consistence, be regularly separated from it.

IN fine, as the body is continually decaying, and the parts thereof daily wasting by the necessary actions of life; as by the mutual attrition of the solids and fluids,
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some parts of both are insensibly worn off, and grow unfit for circulation; and as all the particles of the aliments that get into the blood cannot be expended upon nutrition, but in their preparation for that purpose, must afford some feculent matter, nature has taken care to provide methods and ways for the expulsion of these superfluous and recrementitious substances out of the body. The urinary and intestinal discharges are two very considerable evacuations; the last Urine. Stool. seems destined to carry off the gross unalterable remains of the aliments. Sweat cannot justly be accounted a natural secretion, Sweat. but is properly the consequence, or critical evacuation of some foregoing distemper. The most considerable, and equal to, if not exceeding all, is insensible perspiration. Perspiration.

Not only the external surface of the body, but likewise the internal cavities, the mouth, nose, windpipe, lungs, œsophagus, stomach, and intestines, are all covered over with a transpirable membrane, replete with exhaling pores, through which continually and insensibly transudes a subtile effluvium or vapour. So exceeding small are these pores, that Lewen-

hoek computes 125000 of them may be covered by a grain of sand, whose diameter is one hundredth part of an inch; and yet so numerous, that Sanctorius, to whom we owe the invention of this so useful a piece of knowledge, found, that in Italy, in a healthy person, this secretion amounted to five eighth parts of the whole that is taken for meat and drink. In the more northern climates, where the vicissitudes of the weather are more frequent, and the change of the seasons more irregular, it may not be altogether so copious, yet Doctor Keil and Lister, compute it in England to be at least equal to all the sensible excretions.

The perspirable parts.

THESE exhaling pores are the terminations or mouths of exceeding small vessels, which arise from the extremities of the arteries, have no correspondent veins, nor return any thing back to the heart; but carry out of the body these subtilised and exalted humours that are no longer fit to be retained.

The advantages and necessity of perspiration.

THE equability and regularity of this secretion, are of the greatest importance for the preservation of health. Sanctori-

us, in his book de statica medicina, displays at large all its advantages. He tells us, † that if no change happened in perspiration, the body would always continue in health; ‡ and that a physician, who is ignorant of the quantity of his patient's perspiration, deceives him, but cannot cure him. And indeed the necessity of this secretion, and the mischiefs arising from its defects, may be easily gathered from the quantity, as well as the quality of the humour thus exhaled. By its wonderful subtlety and fineness, and continual exhalation through the proper pores, the minute vessels at the extreme surface are kept open, the body is preserved smooth, plump, soft, and flexible, and the whole animal system is freed from the impurities that are incessantly collecting from the circulation and attrition.

IF upon any occasion the pores happen to be obstructed, and the perspirable matter is retained, the skin grows dry, shrivelled, and withered; the vessels shrink, grow together, and become impervious; the

The evils
arising
from its
defect.

† Sect i. aph. 15. ‡ Aph. 15.

the humours regorge, and the circulation is disturbed. By the quantity retained there arises a plethora, and by its noxious quality is introduced an acrimony. Thus is nature overloaded and oppressed, and put under a necessity of lodging the enemy within, or relieving herself from the unnatural load, by the increase of some of the sensible evacuations. Hence are occasioned the spittings, vomitings, diarrheas, copious discharges of pale urine, sweatings, and sometimes hemorrhages, observed in the course of chronical distempers.

The difficulty of restoring it.

THE difficulty of restoring perspiration when stopt may be partly understood from the smallness of the vessels, and their having no corresponding veins; so that whatever once enters them, must either be protruded out of the body, or remain impacted, and render the canal wholly impervious; that is, dead. Hence likewise may we learn the proper method of keeping it up to its due proportion and equability, viz. by keeping the mouths of the transpiring vessels patulous, the humours in general of a proper consistence, and

and the solids duly elastick, to contract and eliminate this superfluous and recrementitious matter.

S E C T. III.

The cure of chronical distempers.

FROM what has been said, it appears, that the primary indication in the cure of chronical distempers, is to render the circulation free and easy, that nature may be at liberty to resume her wonted office, and renew the exercise of the interrupted functions.

The indication of cure.

For the attaining of which end, four things seem chiefly necessary. 1. To resolve the impacted humours. 2. To correct the degenerated texture of the blood. 3. To expel the offending matter. 4. To relax the too rigid, and to strengthen the relaxed fibres of the parts affected; all which require the skill and judgment of the physician, to direct a proper application both of the method and medicine, accord-

according to the difference of the distemper, constitution, or complication of symptoms; since it often happens, that in complicated cases, the intentions of cure become seemingly contradictory, and yet both may be successfully answered, by a judicious order and management in the administration of the various medicinal helps.

WE will now consider the ingredients of Bristol water, and from their experienced nature and qualities, examine how far they may be applicable to the proposed intention; and whether we may not reasonably promise ourselves some assistance from them, in relieving those who have the misfortune to labour under the severity of chronical complaints.

The virtues of the mineral spirit.

THE first and most efficacious principle of Bristol water, was found to be a subtile volatile spirit, unconfined by any art; must it not from these qualities be well adapted to penetrate every where, to enter the minutest canals, and resolve the most obdurate obstructions, even in the nervous passages themselves? Without determining here absolutely the particular nature of
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this spirit, we may at least suppose it to be analogous to the fixed contents, and the most refined part of the impregnation ; therefore very capable of dividing and thinning unnatural coagulations, making its way through the smallest pores, and opening a passage for the evacuation of obstructing matter ; so that in all stoppages and beginning concretions in the very ultimate canalicular fibres, nothing can be imagined more effectual.

THE second ingredient, water, which in this composition has been shown to be the purest, and the freest from all unwholesome mixture, is allowed to be the most universal resolvent in nature. Glew, or isinglass by itself, is insuperable by the strength of the natural powers, yet diluted sufficiently in water, may be taken without inconveniency. And what is the greatest part of all our animal, as well as vegetable foods, but glew, if it is deprived of its watery particles, and reduced to an extract ? Water is the basis of all attenuants ; its parts are so small, as to pervade the minutest vessels of the animal system, resolve the viscous matter that adheres to

The aqueous part.

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their

their sides, and protrude it, in order to be carried out by its natural emunctory, or re-absorbed into the circulation, to be expelled by some succedaneous excretion.

The salt. THE third ingredient, salt, is another powerful dissolver of all preternatural cohesions. Salt, by its solidity, and wedge-like figure, is excellently fitted to cut and divide peccant viscidities, by that means to open a passage through the obstructed canals, stimulate the fibres into gentle contractions, and enliven the sluggish circulation; especially as it may be so perfectly dissolved in water, and therewith conveyed to the remotest extremities. The salt of Bristol water is particularly calculated to answer these intentions; it is chiefly nitre, with a little marine salt, both which, especially the first, operate without heat, a main thing to be regarded in the cure of many chronical distempers. Lixivious and volatile salts, are indeed very attenuating, but then they are so caustick, acrid, and fiery, that they cannot in many cases be administered, for fear of increasing the inflammation and fever, or even coagulating the blood by the increase of heat and motion.

tion. But the others, without violence, resolve the obstructed matter, render it miscible with the watery element, and gently stimulate the vascular fibres to contraction, in order to its compleat expulsion.

IT may be objected here, that if this is the case, these salts dissolved in water, will produce all these good effects, and so render a recourse to such mineral springs unnecessary. These salts may, and are often administered in distempers arising from obstructions with good success; but salt and water only, are apt to exert their virtues in the first passages, by stimulating their fibres too violently into contractions, and occasioning sensible evacuations; as may be observed in waters abounding much with salt, which always prove remarkably purgative or diuretick. Therefore, that the operation of the salts may be suspended, until they arrive at the obstructed passages, in the composition of the most valuable mineral waters, nature has annexed another matter, wherein the salts are as it were involved; by which means, they may circulate in the larger canals without

effect; but arriving at the capillaries, this composition may be then resolved into its compounding principles, and the salts be able to exert themselves fully. This seems to be one of the great uses of

The
earth.

THE fourth ingredient of Bristol water, which was found to be a fine, impalpable, soft, alkaline earth, so nicely prepared by nature, as no art can possibly equal. The further benefit of this ingredient may be the more easily comprehended, by considering the operation and effects of the levigated, absorbent, testaceous powders, to which it seems to bear a pretty near resemblance. By this does it seem well calculated for a sweetner and purifier of the blood; first, by absorbing the acrimonious particles which disturb the circulation, cause spasms, convulsions, inflammations, ulcers, fevers, and prevent nutrition. And, secondly, by acting as a most effectual diaphoretick, clearing the body from recrementitious foulnesses, which clog the human engine, and impede its necessary functions. So exceedingly fine prepared is this alkaline styptick earth, that it may easily pass through the first passages

passages and larger rate of vessels, and accompany the salts and element as far as the smallest canals; there will it probably be separated from them, and by its stipticity brace up the relaxed fibres, by whose contraction the salt and water are further protruded, in order to resolve the obstructed matter, and carry it through the opened passage.

IN general, may we not from these considerations, infer the properties of this noble tepid water to be from the heat and subtile mineral water, resolving, rarifying, thinning, quickning and enlivening the drooping circulation; from the pure element relaxing, cooling, removing all crispations and unnatural stiffness of the solids, and restraining the rapidity of the blood's motion; from the alkaline earth sweetening the blood, absorbing all asperities of the humours, drying up humidities, and strengthening the weakened fibres of the parts affected; increasing insensible perspiration, and carrying off the offending matter; altogether uniting to give a freshness and new life to the whole body, by opening the coalescing canals; in some degree restoring

The virtues of Bristol water in general.

storing youth, or at least deferring very considerably the symptoms and inconveniences ordinarily accompanying the approaches of age?

In the first
passage.

IN particular, the operation of this water seems to be, first, To cleanse the stomach and *primæ viæ*, to correct the peccant humours lodging there, to open the obstructed pores in the coats of the stomach, which were plugged up by the grossness and foulness of the humours falling from the mass of blood, or furred by intemperance and irregular living. Thus will it be supplied with new and healthy juices, appetite and digestion will be restored, and the whole oeconomy quickly reap the advantage. In like manner, in the intestinal tube will it dilate the obstructed mouths of the lacteals, and other vessels opening into its cavity, dissolve the noxious humours which might occasion cholicks, &c. wash them off, and discharge them out of the body.

In the cir-
culation.

BUT when this water gets into the vessels, and there is mixed with the circulating fluids, by the subtlety of its contents, it diffuses itself through the whole habit,
and

and reaches to the minutest capillaries, enlarging the dimensions of the contracted canals, and expanding the obstructed vessels. It corrects the acrimony of the fluids, divides their cohesions, and washes off the noxious or glewy matter that furs the inside of the vessels, carrying it into the circulation, in order to be discharged by some convenient outlet, especially insensible perspiration, the most natural and desirable way, and which this water does more eminently promote.

FROM this idea of the virtues of Bristol water, it will not be very difficult to conceive after what manner it acts in the cure of the following distempers; viz. hemorrhages, inflammations, scorbutick and febrile heats, cutaneous eruptions, scorbutick rheumatisms, habitual gouts, gravel, stone, strangury, diabetes, some dropries, cancers, king's evil, atrophy, consumption; all which imply obstructions of some vessels, a visciduity or acrimony of the humours, or a complication of these.

S E C T.

S E C T. IV.

Diabetes.

Diabetes. **T**HE diabetes was but little known to the ancients, and therefore but imperfectly described before Aræteus, whose definition of it seems more adequate and expressive of its true nature, than what is to be met with in any other author I know. He calls it a flux of humours from the veins, a colliquation of the blood, and continual effusion by the kidneys and bladder.

THE beginning, progress, and termination of this distemper, is for the most part after this manner :

Its symp-
toms.

A copious and more frequent than ordinary excretion of a pale coloured tasteless urine, frothy and white spittle, dryness of the mouth and throat, feverish heat, especially about the region of the stomach and bowels, necessity of drinking often to prevent parching, varicose swellings of the
veins

veins of the abdomen, anxiety and inquietude of mind, decay of flesh and atrophy, an irresistible desire to make water, a fulness about the loyns, haunches and testicles before making, which subsides upon the discharge, the quantity secreted much exceeding what is drunk, intolerable thirst, colliquation of the whole body, and immoderate effusion of water, which gradually grows more soft, or inclining to sweet, an ardent fever, delirium, and death.

THESE are the symptoms commonly attending a diabetes; which, however, are found to vary sometimes, both in order, number, and degree, according to the difference of constitution, the original cause, or violence of the disease.

THE antecedent causes of a diabetes are Its causes. observed to be, whatever may relax and weaken the urinary vessels, dissolve the crasis of the blood, or determine the flux of humours to the kidneys.

HENCE the imprudent use of diuretics. Willis mentions an incurable diabetes, contracted by drinking freely of Rhenish wine only for twenty days. Ii-
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ster another, from the too plentiful use of Knareborough water in ten ; and likewise one from the too frequent use of a syrup made of balsam of capivi.

LARGE and sudden evacuations, lingering distempers, low diet, which impoverish the blood, dissolve its texture, and render it apt to run off at the first outlets.

VIOLENT exercise and labour, excess of venery, the immoderate use of spirituous liquors ; all which prevent concoction, create crudities, cause unequal mixtures and coagulations of the blood, and overstrain the renal vessels.

THE obstruction and stoppage of other secretions, especially insensible perspiration, the largest, and therefore the most necessary of all, when the retained humours occasion a plenitude, would corrupt, and produce many other dangerous distempers, did not labouring nature, for its own relief, substitute some other evacuation. Of this we meet with daily instances in hysticks and hypochondriacks, *
whose

* Hypochondriaci, si frequentibus balneis, eorum corpora reddantur perspirabilia, sani fiunt. Sanct. aph. cii. itet. 1.

whose weakned and infirm stamina are, unable to keep up a full perspiration, and who are liable, upon every vicissitude of weather, or discomposure of mind, to secrete large quantities of an insipid pale water. Such, for the time, have a real diabetes; it is indeed of no long duration, because, as soon as the cause is removed, perspiration is restored, the humours resume their wonted course, and the diabetes is no more. But, was the obstruction not to be resolved, either the diabetes would continue, or another distemper be produced to supply the defect of this secretion; a salivation, catarrh, diarrhea, &c. * Thus it has been observed, that in a violent catarrh, from catching cold, the defluxion of rheum has been diverted from the lungs to the salival glands, where it has continued some time, causing a nervous spitting, and from thence has been turned downwards upon the kidneys, and produced a diabetes.

IMPURE remains of morbidick matter lodged upon the kidneys after the imper-

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* Dr. Strother's essay on sickness and health.

fect crisis of an acute distemper, or when the violence of the distemper happens to weaken considerably these, and the adjacent parts.

IN fine, whatever tends to destroy the equilibrium that ought to subsist between the vessels and their contents, may bring on a diabetes, by disturbing the regular course of circulation, and preventing the proper and necessary secretions; since, by this means, the blood loses its due consistence, and acquires an improper mixture, and the established order of the animal œconomy is destroyed.

The order
of circu-
lation.

IN the mass of blood are contained various sorts of humours, differing not only in magnitude, but likewise in figure and consistence; some being more solid and smooth, others more porous and angular; some more viscid, others less so. On this account, when the whole blood is driven out of the heart into the great artery, some parts thereof will receive a greater moment of motion than others, and according to their figure and consistence move in different directions. The more solid, globular, and least viscid, will make their way

way in a strait line upwards, or towards the head, while the particles of opposite qualities are laterally jostled into the descending arteries, and carried down towards the lower extremities; so that it is probable that one moiety of the blood, which we shall call the spirituous, is destined almost intirely for the functions of the upper extremities, while the other is chiefly appropriated to the uses of the lower parts. Therefore, if from any cause a cacochymy should happen to be introduced, and the light, porous, angular, and viscid particles of the blood be increased, while the more subtile, active, and spirituous are diminished, a greater quantity of the fluids would then be carried downwards; the emulgent arteries which convey the blood to the kidneys, would thereby receive an over-proportion, and consequently a larger quantity of urine be continually separated; it being evident, that whatever particles are applied to the secerning pipes of the urinary vessels, will immediately pass into them, and be carried off that way, if their diameters are no larger than that of a particle of urine.

THUS

The seat
of a dia-
betes.

THUS we see the seat of a diabetes is the kidneys, and though the original fault may, at first, lie at a distance from thence, yet it is unavoidable, but that the renal vessels and glands, must, by a long continued afflux of humours, be at last weakened and relaxed, and so become more and more disposed to continue, or increase this discharge.

IT is likewise evident, that a diabetes may be owing either to a laxity of the renal vessels, to affusion of the blood, or a derivation of the humours upon the parts affected. Two of these causes may concur, or all unite in the production of this distemper, which accordingly becomes more or less complicated, difficult in the cure, and dangerous in the consequences.

The urine.

THE humour discharged in a diabetes cannot properly be called urine, as differing so much from it in colour, taste, and smell. It seems rather to be an afflux of the wasting humours of the body, which ought to be retained, or the new concocted chyle, little altered by circulation; whereas urine is an excrement remaining after full concoction, assimilation, and nutrition.

trition. The urine of a person perishing with a diabetes, was put into a vessel over a gentle fire; before one half was evaporated, a considerable sediment subsided, and at last the whole was coagulated into a glewy mass, in the same manner as the white of an egg, or the serum of the blood would have been by heat. The same quantity of the urine of a healthy person, evaporated almost intirely, leaving only a little fetid sediment behind.

IT will not now be difficult to account for most of the symptoms attending this distemper.

The reason of the various symptoms.

THE dryness and thirst may be owing to the derivation towards the kidneys, of the fluid which was used to moisten and irrigate the mouth and salival glands.

THE heat and fever, to the increased attrition between the blood (now deprived of its thinner parts) and the vessels, which must be still greater in those of the abdomen, as the fluid parts are more immediately drained from the vessels there.

THE veins of the abdomen become varicose by the stagnation of the incrasated blood, which is no longer diluted by the usual

usual influx of lymph from the lymphatic veins.

ANXIETY of mind is occasioned by the same stagnation about the viscera, increasing the labour and struggle of nature in the performance of the animal functions.

DECAY of flesh and atrophy are the necessary consequences of want of nutrition, the chyle being carried off by the kidneys. Thus the solid fibres are no longer repaired; but the greatest part of the corporeal system consisting of fluids (witness the sudden emaciation in some distempers) the most sensible decay and waste proceeds from a colliquative fusion of the blood and humours. The largest, or red globules, are broken down, and resolved into their compounding serous globules; these again into lesser, and so, by degrees, the whole mass is as it were melted down, and evacuated by the kidneys.

WEAKNESS may proceed from want of nourishment: besides, a greater quantity of the blood tending downwards, the head is deprived of its due proportion, and the nerves no longer receive their usual supply.

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THE constant desire of making water, fulness of the parts before making, and their subsiding afterwards, are occasioned by the humours flowing plentifully thither, distending the urinary vessels, and all those adjoining to them, which are again emptied by each succeeding discharge.

THE urine can never be said to be really sweet, it is rather tasteless, wanting the salts which naturally ought to be in it. After a long continuance of this distemper, the urine indeed becomes soft, when the chyle itself and lymph begin at length to be drained off through the dilated passages.

No wonder if the urine exceed in quantity what is drunk, since the whole body, as it were, passes by the kidneys.

LASTLY, The ardent fever and delirium, generally observed to finish the catastrophe, are occasioned by the blood's being thickened, obstructing the vessels, especially in the brain, and circulating with difficulty. Every diabetes, however, is not attended with the same circumstances. Sometimes a person is, by extreme weakness and inanition, quite exhausted; the

head no longer receives its due supply ; the spirits are not secreted in sufficient quantity to fill the nerves ; whence lipothymias and faintings come on, the heart ceases to contract, circulation is at a stand, and death ensues. Then it is that a fever closes the scene, when a diabetes happens from a defect in the renal vessels themselves, the blood retaining still, in a great measure, its texture, and the solid fibres their elasticity ; in which case, the thinner parts being drained off, the red globules are left to circulate by themselves, without a sufficient quantity of a diluting fluid ; hence increase of attrition, heat, fever, inflammation, &c.

The cure
of a dia-
betes.

THE diabetes is always tedious in the cure, and frequently fatal in the prognostick. The reason of which seems to be, first, It seldom shews itself in any considerable degree, till the evil has taken deep root, and the whole system of solids and fluids is greatly degenerated. Secondly, because plentiful discharges of urine happening often upon so many different occasions ; as from drinking, aqueous diet, hysterick and hypochondriack maladies, and no great in-
con-

conveniencies being immediately felt, the patient flatters himself his disorder may be temporary, and seldom thinks of applying for relief till things are come to extremity.

NEITHER is it easy to lay down any certain rule, or absolute method of cure in this distemper, the variety of causes producing it requiring different applications for their removal; these therefore are diligently to be enquired into, and the medicinal treatment regulated accordingly. At the same time, regard must be had to the various and numerous symptoms constantly accompanying it, as likewise to the subsequent effects.

IN general, the chief and most necessary indications seem to be, 1. To avert the flux of humours from the kidneys, and to determine it elsewhere. 2. To remove all obstructions hindering the other secretions, and to carry off any offending matter that may lodge upon the part affected. 3. To strengthen the weakened and relaxed parts, in particular the renal vessels, in general the whole system, both of solids and fluids.

The indications of cure.

A diabetes
a diarrhea
of the
kidneys.

Dr. Harris, I think, was the first who imagined the diabetes to be a diarrhea of the kidneys, as a diarrhea was a diabetes of the intestines. And indeed these two distempers coincide a good deal both in regard of their causes and effects; both occasioned by a relaxation of the vessels, a fusion of the blood, and determination of the humours upon the part affected; and both producing thirst, atrophy, weakness, extenuation, colliquations, fevers, &c. also the same methods of cure nearly are required in both, viz. diverting the flux, carrying off the peccant humour, and corroborating the parts.

Perspira-
tion al-
ways de-
ficient in a
diabetes.

HIPPOCRATES says, *cutis raritas alvi densitas, & vice versa*. Which sentence may likewise with great truth be applied in a diabetes; for it very rarely, if ever happens, that one secretion is increased, without a sensible diminution of all the rest.

* Hence we see, in this distemper perspiration is always lessened, which is evident, by the body's losing its clearness, smoothness and fulness, the skin's feeling dry, and

* Qui plus mejunt, quam bibunt, parum vel nihil perspirant. Sancto. aph. xciv. sect. i.

and the flesh flabby, from the oppilation of the perspirable pores, and obstruction of the minute capillaries. On the contrary, the increase of perspiration diverts the flux from the kidneys to the surface by revulsion, frees the renal vessels from the continual distillation, and thus gives them time to contract and recover their lost strength and elasticity, whereby they may be enabled to resist the pressure of the flowing humours, and separate from the blood only the excrementitious part, for which purpose they were originally constructed.

WHATEVER therefore might at first have given occasion to the beginning of a diabetes, it is past dispute, that an obstructed perspiration is an unavoidable consequence, and the restoring of that to a proper standard, one of the most likely methods of succeeding in the cure of this distemper.

FOR this reason, and likewise to dislodge the peccant matter, if the patient's strength permit, I would recommend beginning with a gentle vomit. * Hippocrates says,
in

* Sect. vi. aph. 15.

in longa diarrheea vomitus obortus diarrheam sistit. And Celsus * *longas dejectiones supprimit vomitus.* † Dr. Friend very well observes, that by a vomit, all the cuticular passages are opened, and many superfluities discharged; particularly by the ipecacuana root, whose principal virtue he thinks consists in its operation that way. He further tells us from Piso, physician to Prince Maurice, governor of Brasil for the Dutch, who first brought the use of it from thence into Europe, that the Brasilians make use of it as a present and effectual antidote against poisons. And we know, by experience, that administered in small quantities, it proves, in many cases, a very safe and easy sudorifick, and that way often succeeds in the cure of diarrheas. And no doubt it might be made use of to
much

* Cap. 8.

† Comment. de feb. hac quippe evacuandi ratione, non modo primæ purgantur viæ, crudæque materiæ redundantia compescitur; sed cum viscera musculique corporis vehementiori motu agitentur, ipsæque medicamenti particulæ in sanguinem sese insinuent, ita demum resolvuntur humores, ut liberior sit intra vasa tenuia circuitus, & si quid superfluum sit, per cuticulares meatus diffluat. Vide quæ sequuntur apud authorem.

much greater advantage in other cases, if judiciously combined with other medicines co-operating to the same end.

Purgative.

RHUBARB, when compounded in such a manner as not to operate in the first passages, may be sometimes administered with good success, to scour away the dregs of an acute distemper deposited upon the kidneys. Rhubarb seems to have a particular tendency towards these parts, quickly tinges the urine, and by its astringent quality, strengthens and contracts the weakened fibres.

Diaphoreticks.

AFTER these, the administration of proper diaphoreticks, and such medicines as will correct the humours, and invigorate the crasis of the blood, will do a great deal, provided the case is not already become desperate.

Corroborants.

Friction.

RUBBING with the flesh-brush, clears away the filth which sticks to the skin, moves the humours, and opens the pores for their evacuation.

Exercise.

MODERATE exercise, especially riding, increases the reciprocal action of the vessels and their contents, and determines the humours

Bathing.

humours from the center to the circumference. I have observed, that though this exercise was at first uneasy, and rather seemed to increase the urinary discharge; yet, after some perseverance, it was of service, by strengthening digestion, and promoting perspiration.

* BATHING in a tepid bath may be used with advantage as far as is necessary to cleanse the skin, relax the constricted pores, and thin the humour stagnating in the perspiring vessels; but it must be done with caution, and not long pursued, especially when the constitution is already much weakened, lest the pressure of the the water upon the relaxed fibres prevent perspiration, and throw the humours inwards.

LASTLY, Corroborating medicines, that may brace up and strengthen the contractile fibres, and give a firmer and more consistent texture to the blood. Of these there is great variety, the choice of which must be left to the physician, who may, according as the exigency shall require, either calculate them for the restitution of
the

the whole system, or direct their operation more particularly to the affected part.

¶ DURING this course, particular regard is to be had to the natural functions, and great care taken that digestion and concoction be duly performed. The strength of the body depends upon nutrition, and we are nourished by what we eat and drink. Digestion being the result of a great many different parts, contributing to the same end, the stomach and other viscera must all separately do their duty, in order to assimilate the particles of our food, and render them fit for the reparation of what is continually expended, otherwise the whole fabrick will soon fall to decay. And in case any defect arises in this first concoction, it is hardly ever afterwards to be amended in the second, which makes it very necessary to distinguish carefully where the original fault lies, that proper measures may be taken for its more effectual redress. Hence stomachicks differ in their nature as much as do the parts concurring in this compounded operation.

The necessity of digestion and concoction of the aliments.

THIS caution, as it is requisite in all distempers whatever, so is it more particularly

cularly in a diabetes, where the digestive powers are always remarkably deficient. Without good chyle there can be no good blood, and without good blood there can be no sound nourishment.

Milks. FOR this reason, milk (and things easily reducible to that nature, as white meats, *Laeticinia*) is found of so great service, as it is already elaborated, prepared, and digested in the body of the animal, as it is replete with nutritious particles, and wants but little besides the colour of being really blood.

Meats. A diet therefore is to be prescribed of easy digestion, yielding good nourishment, and replenishing the vessels with sound and healthy juices, that may put a stop to the further colliquation of the humours. * Celsus recommends it under the title of *cibus comprimens*, that may bind up the humours, and give them a due consistence.

Drinks. No less care ought to be had in the regulation of drinks, which ought to be in small quantities, always cold, thereby to assist the contraction of the fibres, and
add

* De urinæ nimia profusione.

add to their elasticity. By this contraction, the humours are drove from the centre to the circumference ; and we sometimes find, that a large draught of cold water will, with great ease, procure a sweat, when the warm sudorificks have failed. The temperate use of neat rough wines have the same effect.

THUS may the prudent administration of evacuants, diaphoreticks, analepticks, stomachicks, and astringents, be all brought, in their turns, to answer the above intentions, in the cure of this troublesome, and often fatal distemper.

IN fine, what can we think of the famous Hierā mentioned by Aretæus as an infallible remedy to remove the dryness, heat, and burning of the stomach, and the insatiable thirst in a dropfy and diabetes, but that it was a composition of well attemperated diaphoreticks and stomachicks, opening obstructions, corroborating the weakened vessels, and putting a stop to the excessive discharge of the thinner part of the humours, by promoting all the natural secretions. Scribonius Largus, who

The hierā
of Aretæ-
us.

T 2

gives

gives a more particular description of its nature, and celebrates its virtues with high encomiums, plainly gives us to understand, that it consisted for the most part of antidotes, and tells us, that it infallibly cured crudities and inflations, the most ordinary consequences of obstructed perspiration. *

WHAT the particular ingredients of this composition were, we know not; among the many described by the ancients, we find no one deserve the character given of this, in the cure of that terrible symptom in both these distempers.

THESE hints, however, may serve to encourage the industry of sedulous practitioners to attempt its imitation, by selecting the most efficacious and co-operating antidotes, and combining them into a compound, endued with many virtues. Neither need such an attempt be thought presumptuous, since we see at this day, in many cases, Raleigh's confection preferred to the renowned Mithridate,
held

* Flatus nihil aliud est, quam rude quoddam perspirabile. Sanct. aph. xiii. sect. 3:

held by the ancients to be the noblest invention of this nature.

BUT among all the remedies hitherto recommended in the cure of a diabetes, none comes up to the virtues of the medicinal hot waters of Bristol. These have, of late years, been reputed almost a specific in this distemper, and certainly not without reason, since daily experience proclaims the truth.

The virtues of Bristol water in the cure of a diabetes.

IT will not therefore be unsatisfactory to enquire, whether these waters, by the nature and composition of their ingredients, be fitted to answer the proposed intentions; another advantage may probably accrue from such an enquiry, that, having a pattern set before us by nature, we may, with greater ease, accommodate the diet, exercise, and medicines to the same design, that all may with the water co-operate to a more speedy and effectual recovery.

THE unconfinable mineral of these waters easily diffuses itself through the whole system, resolving obstructions, dilating the smallest vessels, and disposing them for the reception of their proper fluids. Thus arriving

arriving at the extremes of the body, it evaporates through the invisible pores, and opens a passage for the subtilised recrementitious parts of the animal juices to follow, which nature always endeavours to effect, by propelling the whole mass of blood from the centre to the circumference. This spirit likewise, by the extraordinary subtlety of its particles, after coming out of the heart, will necessarily pursue the direction in a strait line, or upwards toward the head; and, by that means, help to divert the flux of humours from the kidneys; at least, it will scarce ever be secreted by urine, but entering the lymphaticks, which abound every where about the viscera, will attenuate their glewy concretions, and restore the lost circulation through the coalescing vessels.

THE salt, whose nature we have already described, is proper to resolve the obstructing matter, divide the viscid cohesions, and gently stimulate the solids to contractions, that they may be able to throw off the superfluities and peccant humours, and discharge them by their proper secretions.

THE

THE fine impalpable alkaline earth, the the product of lime-stone, in some sort resembling the testaceous powders, whereof the most subtle part accompanies the the volatile spirit, and extends its operation to the smallest rate of vessels, is endued with a drying, or even astringent quality; by which, when it enters the minute canalicular tubes, it adheres to their sides, and draws them into contractions, in order to forward the motion of the stagnating fluids, and expel the noxious particles by perspiration. Besides, this astringent earth binds together the particles of the dissolved blood into a due consistence; and when it comes to pass by the secretory canals of the kidneys, will strengthen their weakened and relaxed fibres, contract their dilated orifices, and fit them for the separation only of those humours, which naturally ought to be conveyed out of the body by that excretion.

THE natural warmth of this water, owing to the wonderful subtlety and mutual agitation of these ingredients, and which can be equalled by no artificial heat, will

will add to the vigour, and greatly promote the operation of the whole composition.

THUS, when the volatility of the mineral spirit, the attenuating and stimulating virtue of the salt, the restringency of the alkaline earth, and natural heat of these waters, come to act with an united force, may we not justly esteem them a *hiera* prepared for us by nature, and a composition worthy our imitation?

ADD to this, the advantages of other collateral assistances; a dry, warm soil, a light, rarified air from the elevation of the situation, and the drying effluvia of lime-kilns continually burning. Milk to be had at pleasure from asses feeding upon the choicest vulnerary and balsamick plants, that the patient may, at the same time, take both food and physick with delight. The vicinity of a great city, with markets affording a daily supply of other materials for diet to humour the nicest palat, and to relieve loathing/nature by an agreeable variety, which may, notwithstanding, be always calculated to answer the main intention of cure.

I have

I have been the more particular concerning a diabetes, not only because Bristol waters are generally esteemed a specific in this case, but likewise because this description may perhaps give some light into the question, whether these waters ought ever to be prescribed in a dropfy?

Their use
in a drop-
fy.

THE dropfy and diabetes have many symptoms in common, which are well known, and therefore not necessary to be enumerated; but the individual proper symptom by which they are most essentially distinguished, may be worth our consideration: I mean, the increased quantity of urine in a diabetes, and the diminished quantity in a dropfy. And I doubt not but it may be made appear, that the same remedy may, with judgment, be applied to answer two so seemingly contradictory intentions.

IN a dropfy the solids are remarkably weakened, the fluids glutinous and viscid, unfit for circulation or secretion. By this means, the due equilibrium that ought to subsist between these is lost, and the vessels, especially the small ones, because weak, become, by the constant afflux of

The na-
ture of a
dropfy.

U

humours,

humours, preternaturally distended; whence a stagnation and corruption, hydropical swelling, thirst, defect of the urinary secretion, and all the other symptoms of a dropfy.

Lymphatick vessels.

BUT to put this affair in a clearer light, and the better to trace these two distempers to their origin, we will take notice of some particulars relating to the structure of the parts more immediately affected; and observe, that anatomy has discovered innumerable lymphatick vessels, carrying the lymph, separated from the arterial blood, into the veins, for the dilution of the grosser blood returning to the heart. This appears by Dr. Lower's experiment, who having tied one of the blood veins, found the lymphaticks tending that way swell, and become varicose, from the afflux of the lymph.

MANY lymphaticks are likewise observed to terminate in the meseraick glands, the lumbar cistern, and thoracick duct, for the further preparation and dilution of the recent chyle. All these lymphaticks serve to draw off from the arterial blood the most subtle and fluid part, which would
other-

otherwise be evacuated by the larger outlets, and to return it back to be mixed with the chyle, or the venal blood, after it has been drained by a multitude of other secretions.

FOR it is very evident, that every secretory pore will admit not only its own proper liquor, but also all others of an inferior degree; and thus every thing that is contained in the mass of blood circulating in the emulgent arteries, and passing along the renal strainers, whose particles are not larger than those of urine, must necessarily be separated, and carried off that way. Now the lymph being of a much thinner consistence, and more fluid than urine, would by the kidneys be discharged continually, did not nature thereabouts place lymphatick vessels to draw off the smaller orders of humours from the blood, before it arrives at the secretory ducts.

Is it not evident from hence, that if these lymphaticks happen to be obstructed, the urinary secretions will be increased, the body exhausted, and all the other symptoms of a diabetes ensue? And, on the contrary, if they become weakened

and relaxed, that they will admit not only the lymph, but likewise fluids of a higher order, and a good deal of what ought naturally to be secreted by urine? Hence a dropfical swelling may arise; nay, the contractile fibres may be so far weakened by an increase of this over-distention, as to occasion a rupture of the vessels themselves, and an extravasation of their contained humours, and so bring on an incurable dropfy.

THIS extraordinary dilatation of the lymphaticks depriving the kidneys of their due proportion, may be owing either to the weakness of their contracting fibres yielding easily to the pressure, or to an obstruction of the renal strainers, whereby the urine is retained, a plethora is caused, and the increased humours bear harder upon the mouths of the lymphatick vessels.

AND as Bristol waters diminished the preternatural excretion of urine, by resolving obstructions in the lymphatick vessels, that they might separate their proper fluids, and circulate them in a due manner, and by diverting the flux of humours, and corroborating the parts affected: so
may

may they, for the same reasons, be applied in a dropfy, with good hopes of success, towards removing any obstacles in the urinary pipes, attenuating the viscidities of the glewy humours, drying and strengthening the weakened and relaxed fibres of the lymphaticks; and thus, at different times, prove either a diuretick, or a restringent of that excretion, by restoring the parts affected to their natural state, that every secretion may be duly and regularly performed.

IT is true, all relaxing, softening medicines, are accounted prejudicial in a dropfy; and these waters, on account of their abounding element, may for that reason be suspected. But is not the same likewise true of a diabetes? Besides, what has been already said concerning the nature and seat of these distempers, the consideration of the contents of the Bristol waters, and the observations already made on them, may, in a great measure answer this objection; so that although the aqueous part might at first be supposed to increase the dilatation of the relaxed vessels in a dropfy, yet, by opening the obstructed urinary strainers, it
not

not only passes off that way itself, but draws along with it many other ferofities, and, by virtue of the alkaline earth, gradually strengthens the relaxed fibres, and reduces the vessels to their former compass. It is not to be denied, but there are many dropfies wherein this water of Bristol could be but little depended upon ; as when a dropfy is either occasioned by, or accompanied with inveterate obstructions of the viscera ; when a jaundice, for example, attends it. In such a case, the Bath waters, and other more powerful deobstruents, are to be preferred ; which, by their attenuating quality, may comminute and dissolve the most firm cohesions, and dislodge the glutinous obstructing matter, carry it into the common road of circulation, and expel it by the natural secretions.

BUT to render the waters beneficial in this, as well as in any other case, they must be used under proper regulations, and other collateral helps combined with them, in order to remove all obstacles to the natural secretions, and restore the lost tone of the relaxed fibres.

IN

IN the gravel, stone, and strangury, these waters have been found of singular service, by changing the earthy disposition of the blood, diluting the humours, resolving obstructions in the smallest pipes, washing off the slime and sludge that fur up the kidneys and ureters, dissolving fabulous collections, and calculous concretions, which choak the passages, enlarging the renal ducts, and augmenting the urinary secretion.

IN all inflammations and ulcers of the kidneys and bladder, they claim a chief place, from their mild, drying, and healing qualities, not only by continually passing that way, and thus cooling and cleansing the parts affected, and cicatrising their excoriations, but likewise by allaying the feverish disorder of the blood, smoothing and tempering the acrimony of the humours, which irritate the naked fibres, corrode the sore and tender parts, and obstruct their healing.

IN many scorbutick disorders, cutaneous eruptions, king's evil, internal or external ulcers, and beginning cancers, nothing can be imagined more effectual than

Gravel,
stone, and
strangury.

Inflam-
mations
and ulcers
of the kid-
neys and
bladder.

Scurvies,
itch,
king's e-
vil.

than a long continued and well regulated use of these waters: for as such distempers always proceed from acrimony and obstruction in the ultimate canals, the waters, by their pure element, dissolve the sharp and pungent salts floating in the mass of blood, which irritate the fibres into painful contractions, and obstructing the extremities of the vessels, destroy their very texture. By their soft alkaline earth they sweeten the juices, and render the blood balsamick and healing; and by this, and their heat and spirit, open the cutaneous pores, promote perspiration and every other secretion, and evacuate the offending matter.

Cholicks. THEY are greatly serviceable in scorbutick cholicks, which are owing to the acrimonious matter twitching the nervous fibres, and irritating them into painful contractions, destroying the natural ferment of the stomach, hindering digestion, and preventing nutrition.

AND in convulsive cholicks they have succeeded beyond expectation, when all other remedies have failed. These tedious fatiguing cholicks, I believe, upon examination,

nation, will be found almost always to proceed from some considerable suppression or diminution of insensible perspiration, occasioned generally by lying in damp sheets, sitting in wet cloaths, or with wet feet, or otherwise being exposed unseasonably to the cold ; whereby an obstinate obstruction is formed in an infinite number of exhaling pores on the surface of the body, the perspirable matter is repelled, and thrown in great quantities upon the stomach and intestines, exciting the most exquisite and painful sensation ; and afterwards, upon every little irregularity, change of weather, or other accident, this matter is apt to fall back by the same channels upon the bowels, and to cause violent and frequent returns of this distemper. Bathing in these tepid waters, softens the skin, and opens the pores, while their internal use dissolves the obstructions, and protrudes the offending humours towards the canals of insensible perspiration.

FOR the same reason may they be applied with advantage in spasms and convulsions, or violent involuntary contractions

Convul- of the muscles, which generally proceed
sions. from obstructions about the nerves, or
some acrimonious matter stimulating their
tender filaments.

Gout. HABITUAL gout, arthritick and rheu-
matick pains, may be much relieved, if
not absolutely cured by a proper use of
these waters, diluting and thinning the
gross impacted humours, unlocking the
concretions in the extreme capillaries and
excretory canals, restoring the free course
of all the secretions, especially insensible
perspiration, by which nature discharges
the greatest part of the excrements of the
body. * Indeed where nothing is wanting
but to give a fit of the gout, and to fix
the wandering humour to a point, there
is no remedy more effectual than the mi-
neral waters of Bath, to assist nature in
throwing off the offending matter upon
the joints. But to correct the habit, to
digest the morbidick matter, and eliminate
it totally out of the body, so as to pre-
vent the generation of the arthritick hu-
mour,

* Humores podagricorum, etiam si crassissimi sint, solum
per modum vaporis resolvuntur. Sanct. aph. lxxxvii.
sect 1.

mour, seems more properly to belong to the cooling, diluting, alterative waters of Bristol.

THEY are of experienced virtue in all Hemor-
hemorrhages, whether by mouth, nose, rhages.
hemorrhoids, urine, uterus, &c. by allaying the fervour of the blood, suppressing of plenitude, correcting the acriminous particles, which stimulate and corrode the tender fibres, and destroy the texture of the vessels; by strengthening likewise, and bracing the solids, they bring the action of the vessels to an equilibrium with that of their contents, that the circulation may be kept up, and maintained without the least violence to either.

OF no less advantage are they in the Gleets.
fluor albus, and gleets of all sorts, whether proceeding from strains or other accidents. In which cases, the parts are always very much relaxed and weakened by the continual flux of humours, and may be greatly strengthened by a course of these waters, accompanied with a proper regimen. Their salt and element will cleanse away, and scour off all impurities,

and the absorbent earth constringe the dilated orifices; all together promoting digestion, circulation, nutrition, and secretion; but above all, raising a free perspiration, diverting the humour from the parts affected, and affording them opportunity and leisure to regain their lost tone and elasticity.

Consump-
tions.

THEIR known quality in relieving disorders of the breast and lungs, claims a particular attention; and the frequency of consumptions in these kingdoms, where they may be almost said to be endemical, ought to make us set the highest value upon so easy and effectual a remedy.

Their
symp-
toms.

IN all consumptions from affected lungs, the more immediate cause is always an obstruction or infarction of the pulmonary vessels and glands, hindering the free passage of the blood through the minute vessels and labyrinths of that organ. To this obstruction are owing the cough, spitting, difficulty of breathing, hectic fever, wasting, pain in the breast, tubercles, inflammations, ulcers of the lungs, colliquative sweats, diarrheas, &c.

THE

THE advantage which nature receives The use of the lungs. by the circulation of the blood through the lungs, renders their function absolutely necessary for the continuance of health and life ; in them, and by their action, the blood and recent chyle are mixed, elaborated, and prepared for circulation, secretion, and nutrition ; and if they become stuffed, and cease to perform their wonted office, the whole system must quickly suffer in a very sensible manner.

THE antecedent, or more remote causes The causes. of this distemper are numerous, as we find them related at large by authors who have purposely written on this subject. We often see consumptions contracted by irregularities and errors in life, communicated by infection, transmitted by inheritance, produced by a translocation of some morbid matter from another part upon the lungs, or arising from a bad conformation of the parts themselves.

BUT the most common and ordinary Colds. cause of this distemper is cold. * This is

* Frigus genitor est Phthiseos pulmonis, scilicet venu-
lis à frigore constrictis & convulsis. *Hipoc. de morbis.*

Frigida pectori sunt inimica, tussés movent, catarrh
excitant. Id. aph. xxiv. sect. 5.

is the source of those consumptive pulmonary complaints, which daily carry off multitudes of persons of both sexes, and of all ages, and to which the English are more particularly exposed, chiefly on account of the inconstancy of their weather, and the uncertain vicissitudes of their seasons. *

WE already observed, that the inside of the windpipe and lungs is lined with a perspirable membrane, through which exhales continually a subtile vapour, separated by proper vessels from the blood circulating in those parts. Sanctorius, † by collecting the drops on a mirrour, found the quantity exhaled by respiration to amount, in one day, to half a pound; which his commentator, Dr. Lister, thinks too low a calculation, and computes it at one fifth of the whole, i. e. near a pound.

The effects of cold.

No wonder then, if when the mouths of these exhaling vessels are, by the sudden application of an intensified cold, constricted, the perspirable humour is fixed, condensed, and

* *Causæ externæ, quæ prohibere solent perspirationem sunt aer, frigidus, cænosus, humidus, &c.. Sanct. aph. lxxvii. sect 1.*

† *Aph. v. sect. 1.*

and converted into pituitous phlegm, stuffing the lungs, causing an inflammation and fever, and gradually bringing on a consumption in all its different stages.

FROM these evident principles, it will not be difficult to conceive after what manner Bristol waters become serviceable in the cure of this so dangerous a malady.

By their cooling and diluting properties, they will attenuate the thickened humours, and allay the fever. By their warm, active spirit, and resolving salt, they will open the infarcted lungs, and restore them to their functions. By their soft alkaline earth, they will absorb and sheath the acrimonious juices, fortify and strengthen the weakened fibres ; for in all consumptions of the lungs, the humours quickly become sharp and pungent, not only from their stagnation in the affected part, but likewise from the quantity of the retained perspiration corrupting in the body, and depraving the whole mass of blood. In general, they wash away all impurities, purifying the blood, by opening the proper emunctories, promoting all the accustomed secretions, especially insensible perspiration ;

spiration; the obstruction of which, for the most part, gives the first rise to this distemper.

It must not, however, be imagined, that Bristol water is absolutely a specifick in consumptions, without any regulation or regard to other collateral assistances. A proper regimen in diet, exercise, medicine, and other non-naturals, is equally necessary; but so much may, with justice, be affirmed, that no one internal remedy has hitherto come up to them in the alleviation and cure of such complaints; since it has been found that consumptions, even in their last stages, when the obstructed parts of the lungs were come to suppuration, and an ulcer was manifest, when the body has been wasted to a skeleton, when nocturnal sweats were profuse, and even colliquative diarrheas were common, a sudden stop has been put to the rapid career, the symptoms gradually mitigated, and a recovery at last obtained by the regular and long continued use of this water, and a strict milk diet. Yet ought not this to encourage any one to delay making proper application in the first attacks of so deplorable

nable a distemper, since the success cannot always be warranted in such internal complaints; the parts may be so dangerously affected without apparent exasperation of symptoms, as to disappoint sometimes the most reasonable expectations under the best conducted method of cure.

THERE are several other distempers in which this water may be administered with advantage. But, from what has been already said, the application will not be difficult; and to say more, may, perhaps, be thought little better than a repetition.

IN general, the use of these waters is both innocent and safe, notwithstanding their powerful virtues; the patients, in most cases, may drink freely of them, and without reserve: and though it is not always so, yet if any one will venture without directions, I know of no medicinal water, in the use of which a person may with less risk be his own physician.

*The use of
Bristol
water safe.*

THE proper season for drinking is the warmer months; for although the waters differ nothing sensibly, nor are altered by the seasons, yet is their use much more

*The sea-
son for
drinking.*

Y

advan-

advantageous in summer than in winter ; cause then perspiration is freest, and the operation of the water is greatly promoted by the warmth of the weather ; whereas in winter, the external cold, especially in weak people, suppresses perspiration, hinders the alterative quality of the waters, and throws them off without effect by the sensible excretions.

ADD to this, that in summer there are more opportunities, and better conveniences for the free enjoyment of air, and use of exercise, which, in many distempers, contribute not a little to the cure.

Preparation of the body.

As to any previous preparation, where the particular circumstances of the distemper does not otherwise require it, very little is necessary. A gentle vomit of hypocacua-na, or laxative of rhubarb and cassia, may be of service to cleanse away the impurities and phlegm lodging in the first passages, which might otherwise be carried into the circulation with the water, and there do mischief. In some cases, as scurvies, gouts, and rheumatisms, brisker purges may be requisite ; and, in the course of drinking,
various

various indications may occur, about which no particular directions can be given.

THE quantity commonly drunk, is for How much is to be drunk. the first day's two half-pint glasses in the morning, at half an hour's distance, near as much in the afternoon, and a glass going to bed. This may, by degrees, be increased to double the quantity, though the first is sometimes too much for some constitutions, where two glasses of the third part of a pint each, is as much as they can bear. But in this article it is carefully to be distinguished, whether the whole system is to be altered, and all the secretions at once equally promoted, or whether the defect of any particular secretion is to be amended. If the first, the water is to be used in small quantities at a time, and often repeated, that so excellent a medicine may be gradually introduced, intimately mixed with the blood, and equally diffused through the whole habit; and to prove an universal alterative, reducing every part, and restoring it to its natural state and condition. In the second case, larger quantities may be freely drunk, and oftener, and other means combined to determine their

operation to the part affected; as in the distempered kidneys and bladder, where a continual flood of this cleansing, soft, and healing fluid, passing that way, gently removes all their disorders, and restores them to the free exercise of their usual functions.

The
symptoms
arising
from
drinking
this wa-
ter.

VARIOUS symptoms appear in different constitutions upon the first use of this water, which a physician easily knows how to obviate or remove. Sometimes a diarrhea happens, which prevents the water's getting into the habit, and hinders its intended effect. This is owing commonly either to a great weakness of the stomach and bowels, to an obstruction of the mouths of the lacteal vessels, or impurities lodging in the first passages, and soon go off of themselves, or may be remedied by diminishing the quantity, by exercise, a gentle vomit, or easy diaphoretick. Sometimes the water gets too fast into the circulation, fills and distends the vessels, causing a head-ach, which a gentle opener or diuretick, and a short intermission from drinking, will soon relieve, by lessening the plethora.

ONE

ONE of the most uneasy symptoms, is a great sinking and lowness of spirits, which may be observed to happen chiefly to such persons as have their solids very much relaxed, and inveterate obstructions about the nerves. In such cases, the vessels being suddenly filled, and the water not finding a free passage through the obstructed terminations, the relaxed fibres are distended beyond their natural tone, and are unable to resist the increased pressure of the fluids, or promote their circulation. This symptom may be relieved effectually by the help of strengthening cordials and nervous medicines, gently stimulating the languid solids into contraction, and bringing them to a just equilibrium with the contained fluids.

As to diet, it is impossible to give particular rules that will suit every case and constitution; some admitting of a freer way of living, while others must be confined to a strict regimen, if they will use these waters to advantage. In general, the diet should be temperate. Foods of light digestion, and easy perspiration, are to be preferred to those of a contrary quality. High seasonings, and inflaming liquors,
are

are to be avoided, as contrary to the intention for which this water is used.

IN like manner are exercifes to be regulated, as riding, walking, dancing. The paffions are to be kept within bounds, every excefs in them exafperating the diftemper, and hindering both the firft and fecond concoctions. Sitting up late ill agrees with the design of thefe waters. Dinner at one of the clock, a light fupper at feven, and a large glafs of water going to bed, would keep the body free and eafy, and create no obftacle to nature in performing the operations of the laft concoction.

THE advantages of bathing in this water, and accompanying the drinking of it in fome cafes with the cold bath, might here be enlarged upon; but the ufe both of cold and hot bathing are too well known to phyficians, to need any explanation, and without their directions, it is feldom fafe to venture upon either. In rheumatifms, fluor albus, glects, cutaneous diforders, bathing generally will agree with the drinking; but in hemorrhages, heftick fevers, confumptions, inward ulcers, inveterate obftruc-

obstructions of the viscera, &c. bathing might do a deal of mischief, by throwing all the humours inwards, and bearing too hard upon the affected parts.

MUCH more might be said concerning the virtues and uses of these waters; but having already exceeded the bounds of the first design, I shall only add, that this treatise was not begun for the information of those of the faculty, who have already had experience of their virtues, and are probably acquainted with all, or more than what is here laid down, but chiefly for the use of those who are seated at a distance, and perhaps never had an opportunity of knowing where to find so effectual and easy a remedy for their infirmities and diseases.

By this means, some service may be done to mankind, and some justice done to this noble natural physick.

F I N I S.

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